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THE IRON TRADE REVIEW

A Weekly Journal Devoted to the Machinery, Metal-Working and Foundry Trades, and Iron and Steel Manufacture.

VOLUME XXXVII CLEVELAND, OHIO, NOVEMBER 3, 1904 NUMBER 44

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THE IRON TRADE REVIEW

VOLUME XXXVII CLEVELAND, OHIO, NOVEMBER 3, 1904 NUMBER 44

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The pig iron market has passed through another week of activity and excitement, with added evidences of the remarkable change that has come in the past fortnight. Southern pig iron is now established on a level $2.50 above the $9.50 low point of the year for No. 2, while in Northern irons the advance has been about $2, or to $13.50. The stand for $12 taken by the Southern furnaces was quickly responded to in the North, with indications that the gap between delivered prices of the two sections will soon be wiped out entirely. As in all such movements, the question comes up of the ability of idle furnaces to get into working shape and add to the supply of metal. In the South coke is the key to the situation. As long as the coal strike continues pig iron production cannot expand greatly, but with a rising iron market and the consequent increase in coal miners' wages, on the sliding scale, the chances of increasing the working force improve, particularly with the approach of winter weather. There is some slack capacity among Northern foundry furnaces, but it will be hampered in getting in by the difficulty of securing a sufficient ore supply so late in the season, and some account is to be taken of the approach of the season of coke shortage through car shortage and the winter interruptions to railroad operations.

The week has added another heavy installment to the tonnage of pig iron sales that in the past month have exceeded any month's record since the summer of 1902. There has been in the latter half of October an unmistakable expansion in the business of the foundries and the buying of pig iron has indicated a larger aggregate of uncovered wants for the balance of 1904 than had been estimated. There has been considerable inquiry also for iron for the first quarter of 1905 and furnaces have sold conservatively for that delivery. Business for the second quarter is also under negotiation. At Chicago 50,000 tons of iron has been taken in the past week on a scale up in prices and Southern iron has been established at $12 Birmingham for No. 2. In the East, furnacemen who met at Philadelphia ten days ago to hear the report of a committee that had been unsuccessful in securing freight reductions from the railroads went home to find inquiries coming in from all directions. Basic iron advanced 50 cents in the week, sales being made at $13.50 at furnace. Eastern foundry irons have been rapidly approaching a parity with the new Southern prices, though furnacemen have been chary about selling for next year in view of the advances in coke and in some cases their insufficient purchases of lake ores.

In the Mahoning and Shenango Valleys the position of the merchant furnaces is very strong. They are practically sold up to Jan. 1, and are asking higher prices than those of a week ago for both foundry and Bessemer irons. A large inquiry for Bessemer iron for shipment to Buffalo is reported, following purchases of Bessemer by the same interest from association furnaces two weeks ago. At the moment $13.50 is asked for Bessemer for the first quarter of 1905. Coke has risen under heavy buying by the furnaces. Some contracts were made for the first half of 1905 at $1.60, but $1.85 is the basis today.

Steel billets are very firm at association prices and producers are already discussing an advance to take effect Jan. 1. The restoration of the $2 a ton extra for forging billets, which was taken off at the last meeting, reflects the strengthening influences at work, which will naturally extend to finished materials. Merchant pipe advanced another point on Nov. 1 and in bar iron prices are up about $1 a ton in the week. Otherwise prices of finished materials are unchanged as yet. In wire products there is little leeway at present prices for the mill that buys billets in the market, and with improving trade prospects, higher prices are looked for on the next buying movement.

New car and vessel work have greatly improved the winter outlook for plate mills, and structural mills are fairly well engaged. The railroads are counted on to be active factors in the market before the close of the year. Throughout October the rail mills made heavy shipments to Canada, exceeding their September export record, which was the largest in months. The L. & N. is reported to have increased to 50,000 tons a smaller order given some time ago to the Tennessee company.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
429 PARK BUILDING, Nov. 2

After two months of unusual activity the iron and steel market is commencing to settle down, and with consumers' requirements pretty well covered until the first of the year, producers are not anticipating any great buying movement until the latter part of December. Demand for raw material throughout this buying movement has been proportionately greater than for the finished products, and the prediction is made that this condition may result in a slightly weaker market in some lines during the next two months. Prices of pig iron have advanced rapidly and it is questioned if the advance has not been too rapid. However, few of the Northern furnaces have iron to offer before the first of the year, while the stacks that are now coming in are pretty well sold ahead. In the South the situation continues unusually strong and while the strike continues there is no probability of a lower market. During the week the buying of iron has been comparatively light, although one Youngstown consumer covered for 15,000 tons of Bessemer until the end of the year One sale of 1,000 tons of basic for December, January and February shipment was made on the basis of $13 at the furnace, while two lots of 1,000 tons each of Southern No. 2 for delivery the first quarter of next year were sold on the basis of $12 Birmingham. The sales of furnace coke for the first half of next year have been unusually heavy and practically all of the merchant furnaces in the Valleys closed contracts within the past few days. None of the operators were able to close for strictly Connellsville furnace coke below $1.60 and one contract was on the basis of $1.80. Some deals were on the basis of $1.65 for the entire six months, while others stipulated this price for the first three months, and for the remainder of the term $1.70 would have to be paid. A num-

ber of operators are still in the market and it is considered doubtful if they will be able to do better than $1.85. The United States Steel Corporation now owns and controls the output of 18,200 ovens in the Connellsville region, 16,000 of these ovens being located in the upper region. Independent furnace interests own only 1,150 ovens in the region, indicating that although the latter have been active in securing a fuel supply in the past two years their efforts in this direction have not had nearly as great an outcome as in the Lake Superior ore regions. The remaining 10,000 ovens in the Connellsville region are required to supply practically all of the foundry demands and those furnace interests that have not taken care to provide an independent fuel supply; and with so limited a field as the Connellsville region to draw upon the time is not far distant when the demand for this high grade coke will exceed the supply, and an era of much higher prices is looked for. While excellent coke properties have been developed in other fields it is the consensus of opinion among furnace operators that nothing has yet been found that will fully replace the Connellsville product.

The demand for finished material is heavy but it is not of sufficient volume to bring about general advances, although another point has been added to the price of pipe. Plate mills have not yet received specifications from shipyards and steel car works on the new business recently closed, and they are not expected for another month. New business in structural shapes and rails is light. Demand for both iron and steel bars is good, and iron bars have been advanced to 1.35c Pittsburg. The sheet market is strong, although there is an abundance of idle capacity. The mills are booking considerable business for future delivery, but there as is yet no necessity of an increase in the number of active mills. On account of the recent advances in raw material there has been considerable talk of an early advance in steel, but it is doubtful if anything will be done until after the election and it is probable that the advance will be deferred until the first of the year. Rail makers will meet within a few weeks, but no possible prediction can be made with reference to the action they will take. A meeting of the rail makers and the rail freight association was held in Buffalo last week, some irregularity having been reported in freights, but their action is not disclosed.

Pig Iron.—This week the LaBelle Iron Works blew in furnace No. 2, while the stack at Lowellville, O., also resumed operations. The furnace of the Cherry Valley Iron Co., Leetonia, O., will resume in about ten days, while a coke supply is being accumulated at New Castle so that the Atlantic stack of the Republic Iron & Steel Co. can resume. The Struthers furnace, Struthers, O., resumed last week. No date has been fixed for the resumption of other idle Valley stacks. Pig iron prices have again advanced during the week, some operators now holding No. 2 foundry on the basis of $13.75 at the furnace. Bessemer is held at $13.25 to $13.50 and basic on the same basis. Southern iron is firm at $12 Birmingham, although a little iron is still offered until the first of the year at $11.75. For delivery next year nothing better than $12 can be done. Forge iron is firm at $13, Pittsburg. We revise quotations as follows:

Bessemer, Valley	$13 25 to 13 50
Bessemer Pittsburg	14 15 to 14 45
No. 1 Foundry	14 85 to 15 00
No. 2 Foundry	14.35 to 14.60
Gray Forge, Pittsburg	12 85 to 13 00
Chilled basic, Valley	13 00 to 13 25
Chilled basic, Pittsburg	13 85 to 14 10

Steel.—Owing to the recent advances in pig iron, higher steel prices are talked of, but it is probable that action will be deferred until the first of the year. Some of the producers are asking an advance of 50 cents above pool prices, but all sales are being made on the basis agreed upon at the last meeting. Forging billets which were reduced to the same basis as ordinary billets at the late meeting have been advanced $2 per ton. We make the following quotations: Bessemer and open-hearth billets, 4 x 4 in., and slabs, up to and including 0.25 carbon, $19.50, f. o. b. mill, Pittsburg, with actual freight added to point of delivery; 0.26 and including 0.60 carbon, $1 advance; 0.61 to 1.00 carbon, $2 advance. Billets smaller than 4 x 4 in., $2 advance; sheet and tin bars, $2 advance. Bessemer and open-hearth rods are held at $25 to $25.50.

Ferro-Manganese.—The demand is not very heavy, and domestic ferro is held at $40 in large lots, delivered at buyer's mill at any point east of the Mississippi. Less than carloads are held at $41 to $42.50.

Spelter.—We quote prime Western grades at 5.30c Pittsburg, in carload lots.

Muck Bar.—We note the sale of 1,000 tons of neutral bars at $25.85 Pittsburg. The recent advances in forge iron have resulted in proportionate advances in muck iron

Skelp.—We note the sale of 1,200 tons of grooved steel skelp at 1.30c Pittsburg. Sheared steel is held at 1.35c to 1.40c, and grooved iron at 1.45c to 1.47½c, and sheared at 1.50c to 1.55c.

Rails and Track Material.—Rail mills continue to operate on orders for Canadian shipment which are being pushed forward as rapidly as possible this month. The makers of light rails are not securing much higher prices for their material, although they have been talking of making considerable advances. We quote as follows: Standard sections, 50 lb. and over, in lots of 500 tons and over, $28; car lots and less than 500 tons, $30; less than car lots, $32; light rails, 16 to 40 lb., $20 to $23. Spikes, 1.55c to 1.60c.

Plates.—It is now estimated that the car works have orders on their books for fully 25,000 cars. Most of these will be all steel, and plate mills are expecting to receive heavy specifications within the next four weeks. Orders for the material for lake carriers are also expected to come forward shortly, and the outlook for a steady run of the plate mills throughout the winter months is unusually bright. We repeat quotations: Tank plate, ¼ in. thick, 6¼ to 24 in., inclusive, 1.30c f. o. b. mill, Pittsburg; over 24 in. up to 100 in., 1.40c. Extras are as follows per pound: Flange and boiler steel, 10c; marine, A. B. M. A., and ordinary fire box, 20c; still bottom, 30c; locomotive fire box, 50c; plates over 100 in. up to 1.10 in. in width, not less than 5c per 100 lbs. extra; plates 110 in. to 115 in. wide, not less than 10c extra; 115 to 120 in., 15c extra; plates 120 in. to 125 in. wide, not less than 25c extra; plates 125 in. to 130 in., not less than 50c extra; plates 130 in. wide, not less than $1 extra; plates 3-16 in. thick, $2 extra; gauges 7 and 8, $3 extra; No. 9, $5 extra. Five cents extra for less than carloads. Terms net cash in 30 days, and for all points of delivery in the United States except the Pacific Coast.

Bars.—Demand for both iron and steel bars continues good, and manufacturers of iron bars have advanced prices. The minimum on iron bars Pittsburg is 1.35c, and one large producer is securing 1.40c. We make the following quotations: Bar iron, 1.35c to 1.40c, Pittsburg; hoops, 1.55c, and bands, 1.30c, both taking bar extras. Bessemer and open-hearth steel bars, 1.30c; plow and cultivator beams, 1.30c, net; channels angles, zees and tees, under 3 in., 1.40c. The following differentials are maintained on steel: Less than 2,000 lbs. of a size and not less than 1,000 lbs., 10 cents advance; less than 1,000 lbs. of a size, 30 cents advance.

Structural Material.—Little new business is being placed, and the mills do not expect any increased tonnage until after the first of the year. Quotations are unchanged as follows: Beams and channels up to 15 in., 1.40c; over 15 in., 1.50c; angles, 3 x 2 up to 6 x 6, 1.40c; zees, 1.40c; tees, 1.45c; angles, from 3 to 16 in., 1.40c; universal and sheared plates, 6¼ to 24 in. inclusive, 1.30c; over 24 in., 1.40c base.

Sheets.—The market is firm at 2.10c for 28 gauge, and in

a few instances mills are asking 2.15c. The volume of new business, while large does not warrant the early resumption of the large number of idle mills. We quote black sheets, one pass as follows: No. 8, 1.60c; No. 9, 1.65c; Nos. 12 to 14, 1.70c; Nos 15-17, 1.75c to 1.80c; Nos. 18-21, 1.85c to 1.90c; Nos. 22-24, 1.95c; Nos. 25-26, 2c; No. 27, 2.05c; No. 28, 2.10c to 2.15c; No. 29, 2.35c to 2.40c; No. 30, 2.50c to 2.55c. Galvanized: Nos. 12-17, 2.20c to 2.25c; Nos. 18-21, 2.35c to 2.40c; Nos. 22-24, 2.50c to 2.55c; Nos. 25-26, 2.65c to 2.70c; No. 27, 2.90c; No. 28, 3.10c; No. 29, 3.45c to 3.50c; No. 30, 3.85c to 3.90c.

Pipes and Tubes.—On Tuesday, Nov. 1, quotations on iron and steel pipe were advanced one point. This is an advance of two points in as many weeks. Demand for pipe is much better than it has been and while prices are still very low consumers are covering for future requirements. Discounts to consumers, carload lots, f. o. b. Pittsburg, plus freight to destination according to Tube Rate book, are revised as follows:

MERCHANT PIPE.

	Steel.		Iron.	
	Black.	Galv.	Black.	Galv.
⅛ and ¼ inch	69	53	67	51
⅜ to 6 inches	77	67	75½	65½
⅜ and ½ inch	73	61	71	59
7 to 12 inches	72	57	70½	55
Extra Strong Plain Ends.				
⅛ to ⅜ inch	62	50	60	48
½ to 4 inches	69	57	67	55
4½ to 8 inches	65	53	63	51
Double extra strong plain ends, ½ to 8 inches	58	47	56	45

MERCHANT BOILER TUBES, LESS CARLOADS, 22 FEET AND UNDER.

	Steel.	Iron.
1 to 1½ inches	48	43
1¾ to 2¼ inches	60	43
2½ inches	62	48
2¾ to 5 inches	68	55
6 to 13 inches	60	43

Wire and Wire Nails.—Both iron and steel cut nails are held on the basis of $1.55 per keg by the leading interest, and all efforts on the part of the cut nail association to advance prices while this producer continues to hold his product so low will amount to little. Demand for wire and wire products continues good and orders continue to be booked only for shipment until the first of next month. We make the following quotations: Wire nails, jobbers' carload lots, $1.60; retailers' carloads, $1.65, and less than carloads, $1.75; painted barb wire, $1.75 to jobbers in carloads; retailers' carloads, $1.80, and less than carloads, $1.90, with 30 cents for galvanizing. Annealed smooth fence wire is held at $1.45, with the usual differentials to retailers for carloads and less than carloads. Quotations are all f. o. b. Pittsburg, 60 days, with 2 percent discount for cash in ten days. Iron and steel cut nails are held at $1.65 to $1.70.

Merchant Steel.—Demand is only fair and prices continue unchanged as follows: Toe calk, 1.90c; carriage spring steel, 1.75c; tire steel, 1.50c to 1.55c; plow steel, 6 in. and under, 1.35c for Bessemer and open-hearth; plow slabs, ¼ in. and heavier, 1.60c. Drawn and cold rolled shafting is held at 52 percent off in carload lots and 47 off in less than carload lots.

Old Material.—The old material market is advancing in sympathy with pig iron, and heavy melting stock is now quoted at $13.50, Pittsburg. One transaction involving 10,000 tons of melting scrap for which pig iron will be delivered was closed this week. Dealers continue to hold their material, and are anxious to take advantage of all the profits the market will afford. We make the following quotations, gross tons: Heavy melting stock, $13.50 to 13.75; low phosphorus, $16 to $16.50; rerolling rails, $13 to $13.50; sheet scrap, $11 to $11.50; No. 1 cast, $11.00 to $11.50; No. 1 wrought, $12.50 to $13; and cast iron borings $7.25 to $7.50.

Coke.—Furnace and foundry operators have been covering coke requirements for the first half of next year, and sales of coke the past week have been heavier than at any time this year. Furnace coke contracts were closed at prices ranging from $1.60 to $1.80, while foundry coke was sold at $1.90 to $2.00. Some contracts for foundry coke were placed at $2.50, but this price was only paid for exceptional material. During the week ending Oct. 22, the production of the upper Connellsville region amounted to 192,247 tons, while the lower region produced 61,634 tons. About 8,000 ovens in the two regions are idle. A shortage of water continues to hamper operations, but it has not resulted in the blowing out of furnaces which has been predicted by many coke operators would be the case.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
1164 MONADNOCK BLOCK, Nov. 1.

The noteworthy feature of the present situation in iron and steel is the fact that pig iron at the new prices has more than held its own. After the $11.50 Birmingham basis was established, there was an almost feverish effort on the part of consumers in this territory to get under cover, and the tonnage placed on furnace books in the week under review will easily aggregate 50,000 tons. Today $12 Birmingham is the established basis. Not only are the new prices for both Northern and Southern irons firmly fixed, but there are predictions that still higher prices may rule before the end of the year. Another factor that will aid in determining the probable course of prices will be the developments in the coke market in the next few weeks. For several years past, with the probable exception of 1903, the furnace and foundry interests have suffered severely from a coke famine every winter, these shortages being attributed either to the scarcity or cars or to blockades created by heavy falls of snow. The firmness of the coke market at the present writing and the disposition of producers to hold their material, would indicate that operators look for a repetition of these conditions this winter. When the apathy of railroads in the matter of building new rolling stock and the coal strike in the South this summer are remembered, the fear that with the first spell of wintry weather there is apt to be a sudden stoppage in the supply of coke seems not unfounded. The condition in the South has been further aggravated by the light rainfall this year, resulting in the drying up of many of the streams on which operators depended for their supply of water for quenching coke and washing ore, with the consequent curtailment of production in several plants.

In finished iron and steel, the market has benefited by the activity in the crude product. Several large interests report that the tonnage placed on their books in October was greater than that for any month since the first half of 1902. Specifications for all materials have greatly increased in the last two weeks, notably for sheets, plates and bars. Consumers whose contracts expired Dec. 31 have been particularly eager in covering for their requirements in the first quarter or half of next year, these contracts ranging from 10,000 tons downwards. Bar iron is still selling at 1.40c and sheets at 2.26½c Chicago for No. 28, but both are firm. Should dealers of scrap succeed in holding their present prices, an advance in bar iron will undoubtedly take place. A number of mills are known to have short supplies of old material on hand; and if forced to buy scrap at prevailing prices the finished material will be advanced proportionately. There is little doing in heavy rails, though light sections and track supplies are active. Specifications for structural steel are also improving, the demand being largely for plain material in small lots. Forging billets, wire products, pipe and boiler tubes are all sharing in the general improved conditions, and the outlook is one full of promise.

Pig Iron.—The course of metal markets is interesting from the way they have of occasionally and without warning leaving the beaten path. They may be kept within specified limits for a time, but the day invariably comes when refusing to be held longer in leash, they break away from all restraint. This is what the pig iron market has done in the last two weeks. Not in more than two years have local agents seen such a

demand for iron. As one dealer said, requests for quotations and offers to buy were coming in at every hour of the day, by telephone, telegraph and letter. The flurry spent itself by the end of the week, but during that time furnaces succeeded in placing on their books orders aggregating fully 50,000 tons, practically all of which was taken at the advanced prices. This tonnage was about evenly divided between deliveries for the balance of this year and in the first quarter of 1905, although a number of orders run into the second quarter. The market today is strong at $15.65 Chicago for Southern No. 2 Foundry, and $15 Chicago for Northern No. 2, with very little iron to be obtained either in the North or South for this year's consumption. Northern interests and some Southern producers are asking 50 cents a ton above present prices for deliveries in the new year, although as a rule the Southern furnaces are willing to sell at $12 Birmingham for 1905 deliveries. Malleable iron in some sales has reached $15.50 Chicago, and Lake Superior charcoal $16.50. Virginia irons which sold last week on the basis of $11.25 to $11.75 Birmingham, according to the day on which it was bought, are now strong at $12 Birmingham, or $13 furnace. We have revised our prices, and quote as follows:

Lake Superior Charcoal	$16 00 to 16 50
Northern Coke Foundry No. 1	15 50 to 16 00
Northern Coke Foundry No. 2	15 00 to 15 50
Northern Coke Foundry No. 3	14 50 to 15 00
Northern Scotch Foundry	15 50 to 16 00
Ohio Strong Softeners No. 1	15 30 to 15 80
Ohio Strong Softeners No. 2	14 80 to 15 30
Southern Coke Foundry No. 1	16 15 to 16 65
Southern Coke Foundry No. 2	15 65 to 16 15
Southern Coke Foundry No. 3	15 15 to 15 65
Southern Coke Foundry No. 4	14 90 to 15 40
Southern No. 1 Soft	16 15 to 16 65
Southern No. 2 Soft	15 65 to 16 15
Southern Gray Forge	14 65 to 15 15
Southern Mottled	14 65 to 15 15
Southern Silveries (4% to 6% Silicon)	16 25 to 16 75
Jackson Co. Silveries (6% to 8%)	18 30 to 18 80
Jackson Co. Silveries (8% to 10% Silicon)	18 80 to 19 30
Alabama and Georgia Car Wheel	18 65 to 19 15
Malleable Bessemer	15 50 to 16 00
Basic Iron	15 65 to 16 15

Billets.—There appears to be no cessation in the demand for forging billets, several round lots having been booked by mills in the past week. The amount of small business placed is gratifying to producers, denoting as it does, a marked improvement in the trade of consumers. Prices are without change, and we quote forging billets, 4 x 4 and larger, up to but not including 10 x 10, $24.50. Rerolling billets, Bessemer or open-hearth, 4 x 4 and larger up to .25 carbon, $22.50; up to and including .60 carbon, $1 extra. Billets, 3⅜ in. and smaller, and sheet and tin bars, $24.50. Wire rods, $26 Pittsburg.

Bars.—A marked increase is noted in the specifications, as well as in new and increased orders for iron and steel bars. This is particularly noticeable in the latter product, many of the contracts at present in force expiring with Dec. 31. A large number of these have been renewed during the week under review, and call for tonnages ranging from 10,000 tons downward. Bar iron is exceptionally strong at 1.40c and it is doubtful if an order could be placed with any Western mill for this year's delivery at less than this price. Some interests are asking $1 a ton higher for immediate shipment and $2 a ton more for delivery in 1905. There is a fair business in angles and hoops; hard steel angles are firm at 1.30c Chicago. We quote mill shipments, Chicago delivery, carload lots, as follows: Bar iron, 1.40c to 1.45c; soft steel bars, 1.46½c; soft steel angles, less than 3 x 3, 1.56½c; hoops, 1.71½c, rates, full extras. Local jobbers are quoting iron bars, 1.70c to 1.75c, base, full extras; steel bars and bands, 1.65c to 1.70c, base, half extras; hoops, 2c to 2.10c, rates, full extras.

Sheets.—The demand for sheets continues to improve, and manufacturers are holding more firmly to their schedule of prices. Some cutting, however, is still reported, though it cannot be traced to any definite source. Several interests are sold up for the balance of this year, and a number of others are declining to quote until prices are higher. Light sheets are especially firm, several makers asking slightly better prices than for the heavier gauges. We continue to quote carload lots, mill shipments, Chicago delivery, as follows: Nos. 9 and 10, 1.71½c to 1.76½c; Nos. 11 and 12, 1.76½c to 1.81½c; Nos. 13 and 14, 1.81½c to 1.86½c; Nos. 15 and 16, 1.91½c to 1.96½c. On box annealed, one pass, cold rolled: Nos. 18 and 20, 2.01½c to 2.06½c; Nos. 22 and 24, 2.06½c to 2.11½c; Nos. 25 and 26, 2.11½c to 2.16½c; No. 27, 2.16½c to 2.21½c; No. 28, 2.26½c to 2.31½c; No. 29, 2.41½c to 2.46½c; No. 30, 2.51½c to 2.56½c. We quote lots from jobbers' stocks as follows: No. 10, 1.90c to 2c; No. 12, 1.95c to 2.05c; No. 14, 2c to 2.10c; No. 16, 2.10c to 2.20c; No. 18, 2.20c to 2.30c; No. 20, 2.25c to 2.35c; No. 22, 2.30c to 2.40c; No. 24, 2.35c to 2.45c; No. 26, 2.40c to 2.50c; No. 27, 2.50c to 2.60c; No. 28, 2.60c to 2.70c; No. 29, 2.70c to 2.80c. Galvanized sheets are fair and prices steady. We quote Pittsburg discounts, f. o. b. mill, 80 and 5 to 80 and 10. For shipment from stock, we quote heavy gauges and wide widths, 75 to 5 to 75 and 10 percent; for light gauges, 75, 10 and 7½ percent to 80 percent.

Structural Steel.—Specifications show a marked improvement over the tonnages of preceding weeks in October, and the outlook is very bright. None of the building contracts which have been pending for some time have been let as yet, though the tonnage from this source is expected to be very large. On structural angles and several sizes of plates, western mills not members of the association are selling $1 a ton below pool prices. With this reservation, we quote the association schedule on carload lots, Chicago delivery, mill shipments, as follows: Beams and channels, 3 to 15 in. inclusive, 1.56½c; angles, 3 to 6 in., ¼-in. and heavier, 1.56½c; angles, larger than 6 in. on one or both legs, 1.66½c; beams, larger than 15 in., 1.66½c; zees, 3-in. and over. 1.56½c; tees, 3 in. and over, 1.61½c, with the usual extras for cutting to exact lengths, punching, coping, bending or other shop work. Store price on structural materials are 1.80c to 1.90c for angles, beams, channels, base sizes, with 1.90c to 2c for 18, 20 and 24-in. beams; tees and zees, 1.85c to 1.95c. These prices are for either random lengths or cut to lengths.

Plates.—Demand is improving, mills reporting several nice specifications in the past week. An unconfirmed report states that the Jones & Laughlin Steel Co., through its local office, closed an order for 6,000 tons of plates for grain elevator work in the last ten days. We quote official prices, with the reservation that some outside mills are shading same, on carload lots, Chicago delivery, as follows: Tank steel, ¼-in. and heavier, 24-in. wide and under, rectangular plates only, 1.46½c base; over 24-in. to 100-in. wide, 1.56½c base; flange steel, 1.66½c base; marine steel, 1.76½c base, all full extras. Plates, 3-16 in. thick, $2 extra; gauges 7 to 8, $3 extra; No. 9. $5 extra. Less than carload lots, 5c extra. Prices from store are as follows: Tank steel, ¼ in. and heavier, 1.80c to 1.90c; 3-16, 1.90c to 2c; No. 8, 1.90c to 2c; flange steel, 2.05c to 2.15c.

Rails and Track Supplies.—The demand for light rails is on the increase, the tonnage closed during October being heavier and at higher prices than has been realized in other months this year. Track supplies are also brisk, the output of western mills being well taken up. There is no demand for heavy sections, and none is expected until after the meeting of the association this month. We quote prices unchanged as follows: Heavy sections, 500 tons and over, $28; less than 500 tons to carload lots, $30; less than carload lots, $32; second quality rails, $27; light rails, $22 to $24; track supplies, f. o. b. Joliet mill, angle bars, 1.30c; spikes, first quality, 1.60c; track bolts, 3¼ x ¾, with square nuts, 2.20c to 2.30c per 100 lb.; with hexagon nuts, 2.35c to 2.45c.

Merchant Steel.—Producers report a continuance of the good conditions noted a week ago. New business and specifications are on the increase, and the entire output of mills goes into immediate consumption. We quote carload lots,

mill shipments, Chicago delivery, as follows: Spring steel, 1.85c; sleigh shoe, flat sizes, 1.51½c; concave and convex, 1.60½c to 1.71½c; cutter shoe, 2.25c; smooth finished machinery steel, 1.71½c; smooth finished tire, 1.66½c; plow steel, 2.20c and upwards, according to quality; toe calk steel, 2.01½c; crucible tool steel, 6½c to 8c; special grades of tool steel, 13c and up; cold rolled shafting, 52 percent from list in carload lots, and 47 percent discount in less than carload lots.

Merchant Pipe.—A brisk demand has been felt for pipe of all sizes, the improvement in orders and specifications since the $2 advance on the 19th being very marked. We quote carload lots, mill shipments, random lengths, f. o. b. Chicago, as follows:

MERCHANT PIPE.

	Steel Pipe.		Guaranteed Wrought Iron Pipe.	
	Black. Percent.	Galv. Percent.	Black. Percent.	Galv. Percent.
⅛ and ¼ inches	70.35	54.35	68.35	52.35
⅜ and ½ inches	74.35	72.35	72.35	70.35
¾ to 6 inches	78.35	68.35	76.85	66.85
7 to 12 inches	73.35	57.35	71.85	56.85

Boiler Tubes.—This product has shared in the general improvement of the iron and steel trade in the last two weeks, and jobbers and producers report a considerable tonnage placed on their books since our last report. Prices are without change, and we quote mill shipments, Chicago delivery, as follows:

BOILER TUBES.

	L. W. Steel. Percent.	C. C. Iron. Percent.	Seamless Steel. Percent.
1 to 1¼ inch	46.35	41.35	52.35
1¼ to 2¼ inch	58.35	41.35	40.35
2½ inch	60.35	46.35	43.35
2¾ inch to 5 inch	66.35	53.35	} Up to 4 inches.
6 to 13 inch	58.35	41.35	} 50.85

The following are the agreed discounts from store:

	Steel.	Iron.	Seamless Steel.
1 to 1½ inches, inclusive	42½	37½	40
1¼ to 2¼ inches, inclusive	52½	35	37½
2½ inches, inclusive	55	37½	40
2¾ to 5 inches, inclusive	62½	47½	47½
6 inches and larger	52½	35	..

Cast Iron Pipe.—Despite the advances in pig iron and strong demand for same, makers of pipe have not seen fit to advance their prices as yet. This being the dull season of the year for cast iron pipe, very little tonnage beyond routine lots has come forward in the week under review. We quote carload lots, Chicago delivery, as follows: Four-in. water pipe, $25.50; 6-in. to 12-in., $24.50; larger sizes, $24; gas pipe, $1 a ton higher.

Wire Products.—No change is to be noted in the demand for nails and fencing. From all parts of the country it continues undiminished, and producers are getting considerably delayed in their deliveries. Prices are without change. We quote carload lots to jobbers, Chicago delivery, mill shipments, as follows: Wire nails, 1.75c; painted barb wire, 1.90c; galvanized barb wire, 2.20c; smooth annealed wire, 1.60c; smooth galvanized wire, 1.90c; polished staples, 1.85c; galvanized staples, 2.15c. Less than carload lots to jobbers are 5 cents higher than above prices. The retail trade is quoted 5 cents extra over the foregoing on carload lots, and 10c extra on less than carload lots. Bale ties are unchanged at 82½c and 5 percent discount f. o. b. Waukegan, Ill., on straight carload lots. Poultry netting, 85 and 5 percent discount from list f. o. b. Joliet and DeKalb, with actual freight allowed not exceeding 50 cents per 100 pounds.

Foundry Coke.—The developments in the coke market have not been of a very active nature in the past week. Considerable interest, however, is manifested in the situation, and both dealers and consumers are apprehensive of higher prices Connellsville 72-hour foundry grades is firm at $2.15 at the ovens, or $4.90 Chicago; Wise County, $4.25 Chicago; and Pocahontas and New River, $4.40.

Old Material.—Prices of scrap have again been "boosted" by dealers, and are from 75 cents to $1.50 a ton higher than a week ago. The principal cause for this is the general improvement in the demand for iron and steel products, and the knowledge that several large consumers are in the market for varying tonnages. The two railroad lists reported last week, viz., the Burlington, 4,500 tons, and the C. & E. I., 800 tons, as well as two or three smaller lists from other roads have been bought up by dealers since their publication; and the railroads are said to have got better prices for their material than they have secured in several months past. The local situation is undoubtedly a strong one, and so far as higher prices are concerned, the end is not in sight yet, as one dealer said. We have revised and advanced several of our quotations below and quote present selling prices, gross tons, as follows:

Old steel rails (4 feet and over)	$11 50 to 12 00
Old steel rails (less than 4 feet)	11 00 to 12 00
Relaying rails, subject to inspection	21 50 to 22 50
Relaying rails for sidetracks	18 00 to 20 00
Old wheels	12 50 to 13 00
Heavy melting steel	11 50 to 12 00
Mixed country steel	7 00 to 7 50
Low phosphorus scrap (.04 and under)	12 00 to 13 00

The following quotations are for net tons:

No. 1 R. R. wrought	12 50 to 13 00
No. 2 R. R. wrought	11 50 to 12 00
Shafting	12 50 to 13 00
Dealers' Forge, No. 1	10 00 to 10 50
Wrought pipe and flues	9 50 to 10 00
No. 1 cast, 150 lb. and less	11 00 to 12 00
No. 1 mill	6 00 to 6 50
Country sheet	5 00 to 5 50
No. 1 boilers, cut	9 50 to 10 00
Boiler punchings	9 50 to 10 00
Iron car axles	17 00 to 17 50
Steel car axles	13 50 to 14 00
Iron axle turnings	7 50 to 8 00
Steel axle turnings	7 50 to 8 00
Cast borings	5 00 to 5 50
Mixed borings, etc	5 00 to 5 50
Wrought turnings	7 25 to 7 75
Machine shop turnings	7 25 to 7 75
Railroad malleable	10 00 to 10 50
Agricultural malleable	9 50 to 10 00
Stove plate and light cast scrap	9 50 to 10 00
Old iron splice bars	13 00 to 13 50

CLEVELAND

OFFICE OF *The Iron Trade Review*,
1064 ROSE BUILDING, Nov. 2.

The advance in prices of pig iron has continued and, in the opinion of some conservative observers, quotations have been raised more rapidly than actual demand warranted. Fear is expressed that they cannot be maintained. The scarcity of coke, due to an inadequate water supply, is an important factor.

Iron Ore.—The tonnage of unsold ore is now very small and if present conditions in the pig iron business continue, some furnaces will have difficulty in covering their requirements unless the weather this month and next should be unusually favorable for lake traffic. Reports from northern docks of shipments for October have not been received, but indications are that the shipments will aggregate 4,000,000 tons for the month, bringing the shipments for the season to Nov. 1 to 17,600,000. With anything like good November and December weather, there will be no difficulty in making the total 20,000,000 tons. Ore prices are firmer, but buyers have resisted efforts of sellers to advance quotations slightly, and prices remain about as follows: Old range non-Bessemer, $2.65; Mesabi non-Bessemer, $2.50; old range Bessemer, $3.25 to $3.35; Mesabi Bessemer, $2.75 to $3. Freight rates are unchanged.

Pig Iron.—There is much activity and prices are rapidly advancing. Heavy sales have been made on a basis of $13.50 in the Valley for No. 2 foundry and some iron could be bought at these prices early in the week, but $14 is the usual asking price and sales have been made at $15 Cleveland and in a few cases at $15 in the Valley. Forge has sold as high as $13.50, Valley. No iron can be bought at local furnaces at less than $14 for No. 2 and higher prices have been asked. All quotations are subject to immediate acceptance. While little difference is made in price for immediate shipment and for delivery in sixty to ninety days, the high quotations are usually for spot iron. Reports of very high quotations fre-

quently emanate from furnaces which have little iron for sale for the remainder of this year. Furnaces are not anxious to quote for 1905 delivery. Southern iron has been quoted at $12, Birmingham, for No. 2, or $15.85, Cleveland. Some Southern has been sold at this price and the principal producer has advanced its price to $12.50. Coke has advanced and is very scarce, as high as $2.25 to $2.50 having been paid for foundry coke. We quote as follows for Cleveland delivery:

Bessemer	$14 10 to 14 35
No. 1 Strong Foundry	14 50 to 15 00
No. 2 Foundry	14 00 to 14 85
No. 3 Foundry	13 00 to 13 50
No. 2 Southern	15 85 to 16 35
Gray Forge	13 00 to 13 50
Gray Forge, Southern	14 00 to 14 50
Lake Superior charcoal	15 50 to 16 00

Finished Material.—Reports are somewhat conflicting, jobbers particularly saying that improved conditions are not as marked in finished lines as in pig iron. On the whole, however, the outlook is better. About 50,000 tons of plates and shapes have been contracted for by shipbuilders, the orders generally going to concerns interested in companies which have ordered the vessels. In all lines there is less disposition on the part of sellers to urge the making of long time contracts. This is especially true of bars. Bar iron is held at 1.35c at the mill and sellers say it will soon be necessary to advance their quotations to keep pace with the higher prices for scrap. Steel bars at 1.39½c Cleveland for Bessemer and 1.44½c for open-hearth are in good demand. The sheet business shows no improvement. The prices of the principal producers through jobbers are as follows, Cleveland delivery, the freight from Pittsburg being 9½ cents: Mill sales of black sheets in carload lots, No. 10, 1.64½c; No. 11-12, 1.69½c; No. 14, 1.79½c; No. 16, 1.89½c; No. 27, 2:14½c; No. 28, 2:24½c. Galvanized, mill sales, No. 14, 2.24½c; No. 16, 2.34½c; No. 18-20, 2.49½c; No. 22-24, 2.64½c; No. 25-26, 2.84½c; No. 27, 3.04½c; No. 28, 3.24½c. Out of stock black sheets: ¼-in. 1.90c; 3-16-in., 2c. Blue annealed: No 10, 2.05c; No. 12, 2.10c; No. 14, 2.15c; No. 16, 2.25c. One pass cold rolled: No. 18-20, 2.35c; No. 22-24, 2.40c; No. 26, 2.45c; No. 27, 2.50c; No. 28, 2.60c; No. 30, 3c. Galvanized out of stock: No. 16, 2.60c; No. 18-20, 2.70c; No. 22-24, 2.85c; No. 26, 3.05c; No. 27, 3.25c; No. 28, 3.45c; No. 30, 4.25c.

Old Material.—Prices are about 50 cents higher on nearly all kinds of scrap and we have advanced quotations accordingly. We quote as follows, gross tons, Cleveland:

Old iron rails	$18 50 to 19 50
Old steel rails (over 6 feet)	13 50 to 14 00
Old steel rails (under 6 feet)	12 50 to 13 00
Old car wheels	12 00 to 12 50
Steel boiler plate	9 50 to 10 50
Malleable iron (railroad)	12 00 to 12 50
Malleable iron (agricultural)	8 50 to 9 50
Heavy steel	13 00 to 13 50

We quote as follows, net tons:

No. 1 R. R. wrought	$12 50 to 13 00
No. 1 busheling	12 00 to 12 50
No. 1 machine cast	12 00 to 12 50
Iron axles	12 00 to 12 50
Axle turnings	9 00 to 10 00
Wrought turnings (free from cast)	8 00 to 8 50
Grate bars	8 00 to 8 50
Pipes and flues	10 00 to 10 50
Tank iron	9 00 to 9 50
Hoop and band iron	6 00 to 7 00
Sheet iron	5 00 to 6 00
Wrought drillings	7 00 to 7 50
Stove plate	8 00 to 9 00
Steel axles	14 00 to 15 00
Cast borings	5 25 to 5 75

CINCINNATI.

Nov. 1.

The coke market is active and particularly for furnace coke. Quotations for furnace coke range from $1.75 to $2 f. o. b. ovens. Foundry cokes are not relatively as firm and are quoted at $2.10 to $2.40 f. o. b. Connellsville.

Pig Iron.—Another week of activity and advancing prices is of record. Sales in the aggregate have been large but composed of comparatively small orders. A few large transactions are reported, notably 5,000 tons to a car building company and about 3,000 tons to a consumer in Ohio. Two large electrical supply manufacturers are in the market for about 4,000 tons each, but the general inquiry and sales have been in orders from a car load up to 300 tons. The week's business was mainly done on a basis of $11.50 for No. 2 foundry Birmingham and $13 to $13.50 for No. 2 foundry, Ohio furnace. Today, however. $13.50 at Ohio furnaces is undoubtedly minimum and three Southern Ohio furnaces have advanced their price to $14. In Southern iron $12 Birmingham is the figure sales agents generally are quoting. At the advanced prices scarcely enough business has been done to establish a market, but some sales have been made at $12 Birmingham for Southern iron. One of the large Southern producers that has been out of the market is now offering conservatively for deliveries extending into the first quarter of next year at $12, but with a limitation that sales be confined to old customers and these customers be not allowed to contract for more than their usual requirements, in order to prevent speculative buying as far as possible. A speculator today bid $11.50 Birmingham for 10,000 tons of No. 2 foundry without takers. A large proportion of the buyers in territory tributary to this market who have enough iron bought to cover their needs up to the first of the year are declining to follow the advance and declare that they will wait until after Jan. 1 to place their orders. In regard to the resumption of idle capacity in the South it is the opinion of some in the trade that the scarcity of furnace coke will retard such increase in production and that chances are against a speedy material gain in active capacity in that quarter. The car supply situation is also becoming a feature in the trade and the outlook for the winter is not encouraging for sufficient equipment to move low class freight. Current quotations f. o. b. Cincinnati are as follows:

Southern Foundry No. 1	$ 15 25
Southern Foundry No. 2	14 75
Southern Foundry No. 3	14 25
Southern Foundry No. 4	14 00
Southern Foundry No. 1 soft	15 25
Southern Foundry No. 2 soft	14 75
Gray Forge	13 75
Northern Foundry No. 1	15 65
Northern Foundry No. 2	15 15
Southern car wheel iron	17 75 to 18 25

Finished Material.—The market shows increasing activity and well maintained prices. Bar iron is the leader and quotations are advanced $1 per ton as compared with a week ago. Mills are reported as refusing to book orders ahead and are declining to quote for delivery after Jan. 1. Bar iron is quoted at 1.40c to 1.45c; steel bars at 1.43c, half extras, with dealers quoting 1.60c to 1.75c for iron and steel out of store. Galvanized sheets are at 80 and 10 percent off. We quote black sheets, No. 27, at 2.25c in car lots of 500 bundles. Black sheets out of store are selling as follows: No. 28, 2.60c; No. 27, 2.50c; No. 16, 2.10c; No. 14, 2c; No. 12, 1.95c; No. 10, 1.90c. Tank plates are dull and sell out of store at 1.85c for ¼-in. and 1.95c for 3-16-in., No. 8 and No. 10. Beams and channels are quoted at 1.85c from stock and angles at 1.85c to 1.90c for base sizes.

In merchant pipe there is a good jobbing demand and orders from stock are liberal. Car load orders, however, are moderate and independent mills are still slightly underselling the schedule. Car lots are quoted as follows, f. o. b. Cincinnati:

MERCHANT PIPE.
(Basing Discounts.)

	Steel Pipe. Black. Percent.	Steel Pipe. Galv. Percent.	Guaranteed Wrought Iron Pipe. Black. Percent.	Guaranteed Wrought Iron Pipe. Galv. Percent.
⅛, ¼ inch	68.7	52.7	66.7	50.7
⅜, ½ inch	72.7	60.7	70.7	58.7
¾ to 6 inch, inclusive	76.7	66.7	75.2	65.2
7 to 12 inch, inclusive	71.7	56.7	70.2	55.7

BOILER TUBES.

	Steel. Percent.	Iron. Percent.
to 1½ inch	41.2	37.7
1¾ to 2¼ inch	54.2	36.7
2½ inch	56.7	41.7
2¾ to 5 inch	63.2	49.2
6 to 13 inch	54.2	36.7

Old Material.—The market is strong and prices of last week are firm and tending upward, but not quotably different. We quote as follows:

Old No. 1 railroad wrought, net tons	$12 00 to 12 50
Cast machine and foundry, net tons	10 50 to 11 00
Old iron rails, gross tons	14 50 to 15 00
Old steel rails, gross tons	10 50 to 11 00
Old short lengths, gross tons	11 00 to 11 50
Old iron axles, net tons	14 50 to 15 00
Stove plate, net tons	8 00 to 8 50
Wrought turnings, net tons	7 50 to 8 00
Cast borings, net tons	5 50 to 6 00

At a special meeting of the board of directors of the Lunkenheimer Co., Cincinnati, held a few days ago, the resignation of D. T. Williams as vice president was accepted. The following officers were then elected: Edw. W. Lunken, president; C. F. Lunkenheimer and Samuel L. Moyer, vice presidents; William H. Muench, treasurer; David J. Jones, secretary. The result is a promotion for Vice President Moyer, who for several years has been secretary of the corporation. It is understood that Mr. Williams will go into business for himself. He had been connected with the company fifteen years.

NEW YORK.

OFFICE OF *The Iron Trade Review,*
ROOM 1315, NO. 150 NASSAU ST., Nov. 1.

The past week witnessed a continuance of the strong market conditions noted in our last report. Prices for Southern irons show no change from a week ago, when the $12 level was established principally because furnace representatives here have little or no iron to sell for this year, and in some cases are not willing to quote for next year. There are some furnaces not included in either category, but the tonnage of any sales they have made or quotations they may have given is small. Northern irons are stronger in the week, and there have been some extensive sales, notably for delivery in the first quarter of next year. Inquiries have been decidedly brisk during the past week, and there is no doubt whatever that if the furnaces would take orders for next year on the basis of prices which prevailed a fortnight ago, they could place a very large tonnage. This they are unwilling to do, and the average buyer is providing for his nearby requirements with great caution. Southern No. 2 foundry is reported to be selling in other localities at from $11.50 to $12 Birmingham, with sales nearer the latter than the former figure. Northern furnaces are still able to undersell Southen producers in every Northern market, but the margin is getting so close now that its early elimination would occasion no surprise. Reports from foundrymen speak of better business conditions having set in, the activity in foundry coke being looked upon as sure proof, with numerous sales for next year reported at advancing prices. New York quotations at tidewater follow: Northern No. 1 foundry, $15.25 to $15.50; No. 2 foundry, $14.50 to $14.75; No. 2 plain, $14.00 to $14.25; No. 1 Southern, $15.25 to $16; No. 2 foundry, $15.25 to $15.75; No. 3 foundry, $14.75 to $15.25; No. 4 foundry, $14.50 to $14.75.

Rails.—Sales continue to be confined to small lots, but making up a good tonnage, at $28 at mill for standard sections.

Finished Iron and Steel.—Nothing of particular interest has transpired in structural shapes during the past week, current orders being made up of small lots. There is considerable estimating being done, but the business thus far resulting is not large. The railroads hold out the most hope for the near future, and some good orders are expected from that quarter during the present month. The demand for plates has increased, and tonnage booked during the past week made a good showing. Bars are more active also, with some fairly good contracts having been taken. Sheets maintain a strong position so far as prompt shipment is concerned, but sales for future delivery are backward. New York prices at tidewater follow: Angles, 3 to 6 in. x ¼ in. and heavier, 1.54½c; beams, 3 to 15 in., 1.54½c; channels, 3 to 15 in., 1.54½c; beams, 18, 20 and 24 in., 1.64½c; tees, 3 x ¼ in. and heavier, 1.59¼c; plates, carloads, tank, 1.54½c; flange, 1.64½c; marine and ordinary fire box, 1.74½c; refined iron and soft steel bars, 1.44½c; sheets, in carload lots, New York, No. 28, black, 2.30c to 2.35c; galvanized, 3.30c to 3.35c.

Old Material.—The market during the past week has been irregular, being active one day and dull the next, with prices showing considerable firmness, and the demand embracing everything on the list, with scrap of all kinds the feature. The future course of the market is a topic of considerable gossip, with opinion strong that prices are more apt to score a further advance than develop any weakness. We quote f. o. b. cars:

Old iron rails	$14 00 to 14 50
Old steel rails, long lengths	11 50 to 12 00
Old steel rails, short pieces	11 00 to 11 50
Relaying rails	19 00 to 20 00
Old car wheels	11 50 to 12 50
Old iron car axles	17 00 to 18 00
Old steel car axles	14 00 to 14 50
Heavy melting steel scrap	11 50 to 12 00
No. 1 railroad wrought scrap	11 50 to 12 00
Iron track scrap	10 75 to 11 25
Wrought pipe	8 50 to 8 75
Ordinary light iron	6 00 to 6 25
Cast borings	5 00 to 5 25
Wrought turnings	6 75 to 7 25
No. 1 machinery cast	10 50 to 10 75
Stove plate	8 25 to 9 75

PHILADELPHIA.

Nov. 1.

Conditions are very much improved, but it is impossible to predict what the course of the market will be in the next three months, as there is some speculative buying of iron and it may be dumped later, causing demoralization of prices. Business will probably be better for some time unless there is a too rapid advance in prices.

Pig Iron.—The demand has been heavy, especially low phosphorus and basic. Prices are firm and advancing. We quote as follows: No. 1 X foundry, $15 to $15.25; No. 2 X foundry, $14.75 to $15.25; No. 2 plain, $14.25 to $14.50; standard gray forge, $13.50 to $13.75; basic, $13.75 to $14; low phosphorus, $19 to $19.75; malleable iron, $15 to $15.25.

Steel.—Demand is strong and mills are busy. Prices are nominally about $22, but higher prices have been paid. Forging billets have been advanced $2.

Finished Material.—Demand is decidedly better. Some lines are selling more freely than others, but conditions in general are better. We quote as follows: Plates, 1.53½c to 1.47½c; beams, channels and angles, 1.53½c to 1.62c, according to specifications, and small angles, 1.50c to 1.55c; bars, 1.43½c for carload lots for either iron or steel and the usual advances on part carloads.

Old Material.—Prices are firm and tending upward. We quote as follows: No. 1 steel scrap, $14 to $14.50; low phosphorus scrap, $16.75 to $17; old steel axles, $17 to $17.50; old iron axles, $19.75 to $20; old iron rails, $17 to $17.50; old car wheels, $13 to $13.50; choice railroad No. 1 wrought, $16 to $16.50; machinery cast, $13 to $13.50; No. 2 light scrap (forge), $10.50 to $11; light scrap (ordinary), $9 to $10; wrought turnings, $10 to $10.50; cast borings, $7.25 to $7.50; stove plates, $10 to $10.50; wrought iron pipe, $12.25 to $12.75.

BIRMINGHAM.

BIRMINGHAM, Ala., Nov. 1.—Birmingham district furnaces are selling pig iron on analysis at $12 to $12.25 per ton for the equivalent of No. 2 foundry iron. The regular market for No. 2 foundry is $12 a ton and the statement is made that this price is firm. Demand is fairly good considering the advance, but so far very few sales have been made for delivery beyond the first quarter of the coming year. However, there is good inquiry for iron for first and second quarters, with no present reason for doubting that good times will prevail during the first half of 1905 at least. It is predicted that $13 Birmingham

will prevail by the time the new year sets in. The Sloss-Sheffield Steel & Iron Co. and the Alabama Consolidated Coal & Iron Co. appear to be in good shape as to immediate delivery of iron, the two companies apparently having nearly 75,000 tons of iron that can be delivered on short notice, this including a large block of iron recently taken off the market by the directors of the former company.

The production of iron in Alabama is slightly improved again, the Tennessee Coal, Iron & Railroad Co. resuming operations at some of its furnaces which had banked for a few days. The Sloss-Sheffield Steel & Iron Co. will blow in its No. 1 city furnace in Birmingham, which was recently thoroughly repaired. The Tutweiler Coal, Iron & Railway Co. will blow in its Vanderbilt furnace before Nov. 10.

The statement is made that the Alabama Steel & Wire Co. will build a second furnace at Gadsden, Ala., though nothing positive is given out as to when the work will be started. The Woodward Iron Co. will be making iron at its new furnace at Woodward, near here, before the end of the year.

The Republic Iron & Steel Co. started up the Gate City rolling mills yesterday, giving employment to 300 men. There are four rolling mills in operation in the Birmingham district and quite a large amount of pig iron is being used by these plants.

The steel industry in the Birmingham district is very active. The statement is officially made that the Louisville & Nashville Railroad Co. has increased to 50,000 tons a small order recently given for steel rails to the Tennessee Coal, Iron & Railroad Co., to be manufactured at the Ensley steel plant. President Don H. Bacon, of the Tennessee company, in a statement given out this week, says that there are no doubts about the success of the steel manufactured with Southern ores and that rails manufactured by his company had been given a good test by a number of prominent railroads throughout the country and that high commendation was given the product.

Steady business is being carried by the foundries and machine shops in this district, while the cast iron pipe industry is very active. All pipe plants in this section are working hard and melting a large quantity of iron. There will be a larger melt for this year than ever and the indications for the coming year are particularly bright.

The following pig iron quotations are made: No. 1 foundry, $12 to $12.50; No. 2 foundry, $12; No. 3 foundry, $11 to $11.50; No. 4 foundry, $10.50 to $11; gray forge, $9.50 to $10.50; No. 1 soft, $12 to $12.50; No. 2 soft, $12.

The strike of the union coal miners in this district is still on and the coal corporations are bringing in non-union men and are slowly increasing their output of coal. The union miners at work will get an advance in mining wages of five cents per ton.

The Metal Market.

NEW YORK.

OFFICE OF *The Iron Trade Review*,
ROOM 1315, No. 150 NASSAU ST., Nov. 1.

As compared with last week's quotations prices today are higher, but not as high as they were during the week. This is because of the statistics for October, which were compiled by Secretary C. Mayer of the local Metal Exchange, and which were issued today, showing a falling off in deliveries here of 200 tons as compared with September. The total visible supply on Oct. 31 was 12,194 tons, as compared with 13,159 tons on Sept. 30. The arrivals for the month were 2,925 tons, as compared with 1,855 tons Sept. 1, and there is now afloat 1,405 tons, and 1,840 tons on dock and arrivals. The London market, after being very strong, declined slightly, but is considerably higher than a week ago. Closing prices today follow: Spot, 28.75 to 29.00c; Nov., 28.65 to 28.95c; Dec., 28.50 to 28.75c. London's closings today follow: Spot, £131 12s 6d; futures, £132 12s 6d.

Copper.—With export sales larger for October than for any month since January, and with the outlook in the same direction regarded as bright, coupled with the statement that domestic business is increasing perceptibly also, asking prices for all grades are now ½c higher than a week ago. The export sales for October amounted to 26,335 tons, as against 20,469 tons for September. During the week the London market has been very strong, closing at top figures today. Closing prices today follow: Lake, 13⅝ to 14c; electrolytic, 13⅝ to 13⅞c; casting, 13⅜ to 13⅝c. London's closings today follow: Spot, £62 7s 6d; futures, £62 15s.

Lead.—Spot is even scarcer and much higher than a week ago, and is selling at 4.40 to 4.45c. St. Louis is unchanged at 4.20c. London advanced to £12 12s 6d.

Spelter.—Is stronger and more active at 5.35 to 5.40c. St. Louis declined to 5.17½c, and London advanced to £23 15s.

Antimony.—Cookson's is unchanged at 7.25 to 7.50c. Hallet's is stronger at 7.25 to 7.50c, and other grades have advanced to 6.75 to 7.25c.

Quicksilver.—We quote $40 per flask of 76½ lb. in lots of 100 flasks. London is £7 15s.

Nickel.—Sales are made at 40c to 47c for large lots down to a ton, and at 50c to 60c for small quantities.

CHICAGO.

The advances in copper, pig tin and lead during the week past stimulated demand for these metals. Buying has been very free, local consumers covering their requirements for some time ahead. The advances in pig tin and lead are wholly of a speculative nature, due to the decline in shipments of these metals from Europe. Copper was forced upwards as a result of the heavy buying in this country by Chinese dealers, whose source of supply in Japan has been cut off owing to the war in Manchuria. We have revised our prices and quote as follows: Lake copper in carloads, 14c, and for smaller lots, 14¼c; casting, 13⅞c for carloads, and 14¼c for lesser quantities. Pig tin, carloads, 29¾c, and 30¼c to 30½c for less than carload lots. Spelter is unchanged at 5¼c to 5½c, according to quantity. Sheet zinc, 6c for carload lots of 600-lb. casks, and 6.25c to 6.30c for less than carload lots. Pig lead, 4.30c for 50-ton lots; 4.35c for carload lots, and 4.50c for smaller lots.

The demand for old metals is very brisk, and prices are exceptionally strong. We quote copper wire and heavy, 11½c; copper bottoms, 10¼c; copper clips, 11c; red brass, 10¼c; red brass borings, 8c; yellow brass, heavy, 7½c; yellow brass borings, 6½c; light brass, 6c; tea lead, 4c; zinc, 3.65c.

The St. Louis Exposition managers have set apart November 14 and 15 as special days for foundrymen. The foundry on the Exposition Grounds is now working regularly, and will be making tests in one or more of the cupolas, of coke from different parts of the United States. Coal is being shipped from different parts of the country to the exposition grounds, and the coking qualities of this coal are being tested in three of the coke ovens on the grounds. When this coke is at all promising, it is then analyzed and tested in every practicable way, including actual cupola experiments.

At the St. Louis Exposition, the products of the Norton Emery Wheel Co., Worcester, Mass., were awarded two grand prizes and two gold medals. The Norton Grinding Co. received the only grand prize which was awarded for grinding machines.

At a meeting of the directors of the Colorado Fuel & Iron Co. held in New York last week, Frank J. Hearne was re-elected president. No other business was transacted.

A NEW ELECTRIC TRAVELING HOIST.

Electric traveling hoists are rapidly coming into favor and many of the more progressive shops are installing them in place of hand hoists. Besides the direct advantage of handling loads vastly quicker than the hand hoist, the electric traveling hoist has the indirect advantage of increasing the output of the shop by waking up the men. The hoist moves so rapidly that it compels the workmen to be quick in their movements, and instinctively they do their regular work more rapidly. On the other hand, if the workman is using a hand hoist, he is pretty well tired out after he has lifted a load, and does not return to his regular work with much vigor.

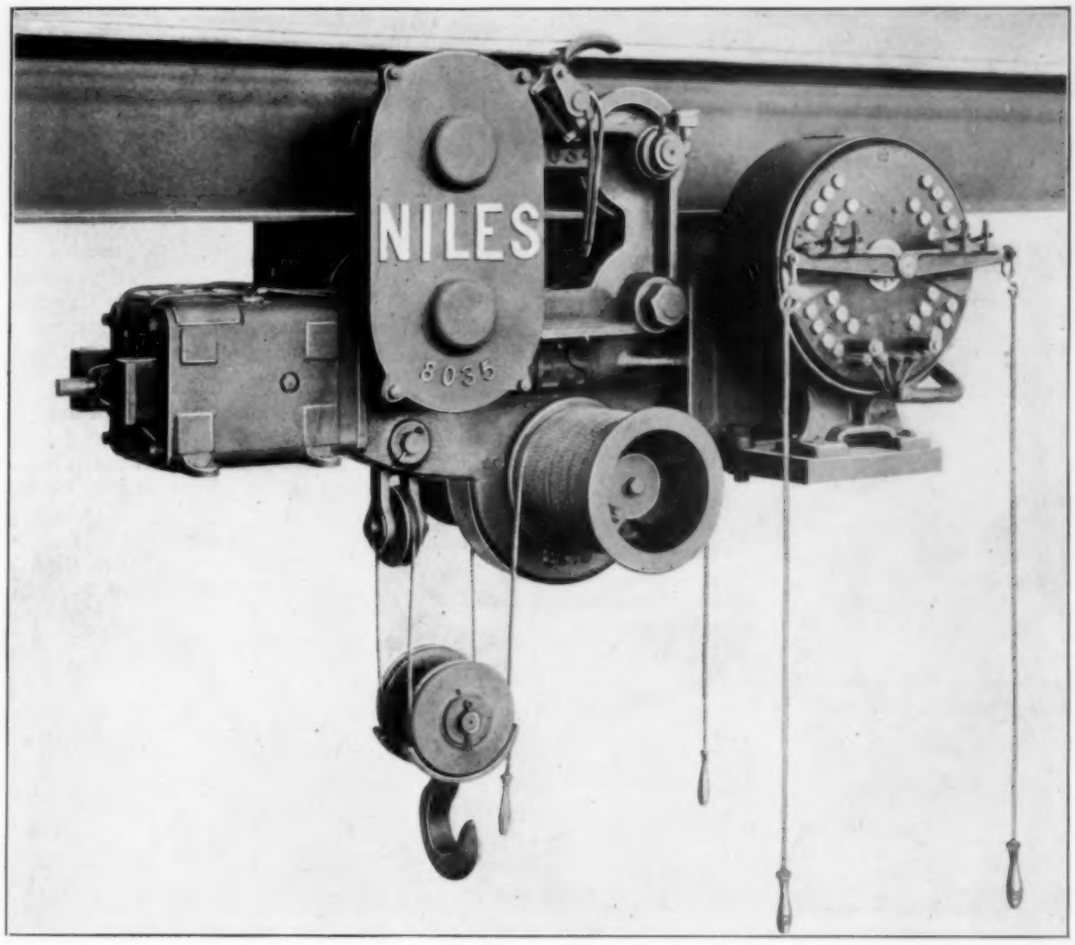
The illustration shows a new type of Niles hoist built in capacities of ¾ to 6 tons and used either as hoists, in which case they run on the I-beam, or when mounted on a traveling bridge they may be used for small capacity cranes. In the latter case, they are arranged to run between the two I-beams or channels of the bridge, and the controllers for raising and lowering the hook and operating the traversing mechanism can be placed either on the hoist, on the bridge and operated by cords from the floor, or in an operator's cage attached to the bridge.

When used on an I-beam, the controllers are attached to the hoist and operated by cords from the floor. These hoists will run on straight and curved tracks and are usually provided with a separate motor for traversing, but if desired, hand traverse may be furnished, or all the traversing mechanism may be omitted and the trolley moved along the track by pushing on the load. The increased service of the electric traverse, however, much more than compensates for the slight additional cost.

The hoist is self-contained in one heavy cast iron frame to which the motors are attached end on, and the power is transmitted directly from the armature shaft to the drum shaft through one train of worm and worm wheel gears.

The traversing mechanism is also driven through one train of worm and worm wheel gears similar to the hoisting mechanism, except that when the trolley is arranged to run on a single I-beam, a double set of transmission gears is used to connect the worm gear shaft to the truck wheel shafts. All the mechanism is enclosed in oil and dust proof castings and is absolutely noiseless in operation.

In addition to the braking effect obtained by the use of the worm and worm wheel, a powerful electric brake is attached to the hoist motor.



A NEW ELECTRIC HOIST.

These hoists are manufactured by the Niles-Bement-Pond Co., of Liberty St., New York.

Upon application of E. Bement's Sons, extensive manufacturers of stoves and farm implements, at Lansing, Mich., capitalized at $1,250,000, the affairs of that corporation have been placed in the hands of the Detroit Trust Co., which will continue the business with a view to liquidating all liabilities and giving the company an opportunity to effect a permanent reorganization.

The directors of the Pressed Steel Car Co. have decided to omit the dividend on common stock and have declared the usual dividend of 1¾ percent on the preferred.

A Stock and Production Order Department.

BY JOHN CALDER.

The general description with organization chart of the Remington Standard Typewriter Factory at Ilion, N. Y., was given on page 69 of *The Iron Trade Review* for Oct. 6, showing the relations between the various productive and non-productive departments. The present article is devoted especially to the stock and production order department, which

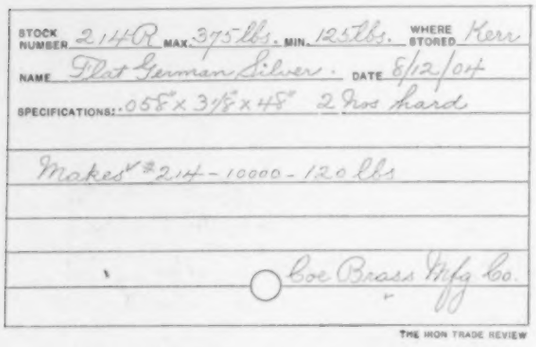

STOCK NUMBER 214R MAX. 375lbs. MIN. 125lbs. WHERE STORED Kerr
NAME Flat German Silver. DATE 8/12/04
SPECIFICATIONS: .058" x 3⅛ x 48" 2 hrs hard
Makes # 214 - 10000 - 120 lbs
Coe Brass Mfg Co.
THE IRON TRADE REVIEW

FIG. 1.—THE ORIGINAL IS 3 X 5 IN., PRINTED IN RED.

is the originating source of all authority to expend labor cost in the factory.

Midway between the problem of efficiently producing general engineering products varying almost constantly in detail and that of turning out simple semi-manufactured goods under the tonnage system, comes the case of the highly finished and complicated product which has reached a purely manufacturing basis.

If the product, be it a cash register, sewing machine, bicycle or typewriter, has been wholly stereotyped in design and a factory has been equipped to produce every component in the exact daily proportions necessary for a given assembled output, it is possible to run efficiently without much stocking of the components. On the other hand, if the article, originally of a single simple type, has become specialized to a high degree for different uses, the standard components will vary largely in their degree of applicability to any one model and

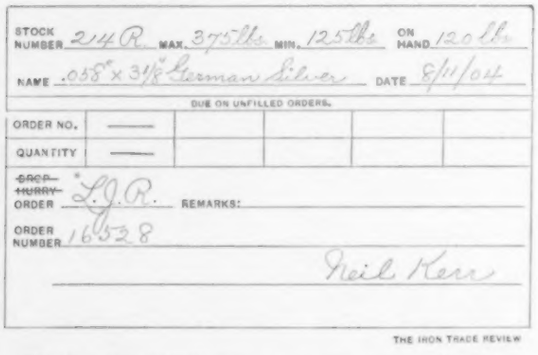

STOCK NUMBER 214R MAX. 375lbs MIN. 125lbs ON HAND 120 lbs
NAME .058" x 3⅛" German Silver DATE 8/11/04
DUE ON UNFILLED ORDERS.
ORDER NO.
QUANTITY
~~SHOP~~ ~~HURRY~~ ORDER L.J.R. REMARKS:
ORDER NUMBER 16528
Neil Kerr
THE IRON TRADE REVIEW

FIG. 2.—THE ORIGINAL IS 3 X 5 IN., PRINTED IN RED.

this will be further complicated by the variation in demand which the creation of a number of types will occasion.

This, of course, will be met as fully as possible by developing the interchangeability of parts and the standardizing of designs; but in a large business the stocking of finished components in a scientific way must take the place of the hand to mouth existence which obtains in so many small factories, where it is attempted to rely more or less securely upon the memory and to trust to freedom from any accident which might arrest production.

To meet the case of the large factory completely, an efficient stock and production order system must (a) purchase economically and timously an adequate, but not too large, amount of raw material and outside supplies, (b) store the same conveniently on a reliable perpetual inventory; (c) issue specific orders to the shops to manufacture, along the best routine, the raw material furnished into components and keep an exact perpetual inventory in the stock room containing the finished components, which are subsequently drawn off for assembled product and (d) keep a reliable perpetual inventory of the work at any moment in any department.

In manufacturing practice, the purchasing has been generally separated from the storing of raw material and both have

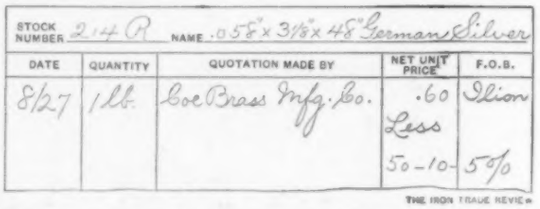


FIG. 3.—THE ORIGINAL IS 3 X 5 IN., PRINTED IN RED.

been carried on independently of the stocking of finished components.

There is much, however, to be gained in manufacturing on a large scale many varieties of interchangeable parts by combining under one department all these functions.

Purchasing.

The purchasing involves the procuring of over 70,000 distinct products at intervals for factory uses and the regular and economical supply of over 2,000 varieties of raw and semi-manufactured materials which enter into the composition of typewriters.

The particulars of contracts concluded by the management and the names of approved suppliers are furnished to a purchasing clerk and the work of this branch is adequately and economically performed in the following order, in which 3 x 5 in. card records are almost entirely used. All forms relating to outside suppliers being printed in red while the factory forms are all printed in black.

Supplies for factory uses are consecutively numbered and

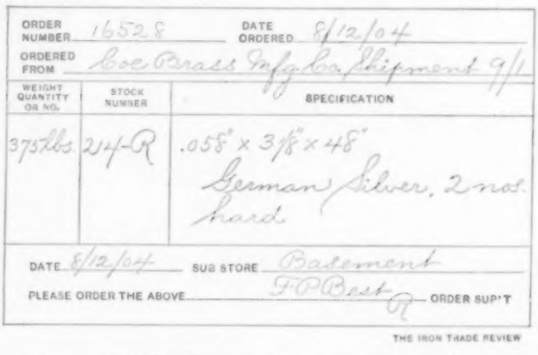

ORDER NUMBER 16528 DATE ORDERED 8/12/04
ORDERED FROM Coe Brass Mfg Co. Shipment 9/1
WEIGHT QUANTITY OR NO.
STOCK NUMBER
SPECIFICATION
375lbs
214-R
.058" x 3⅛" x 48" German Silver, 2 nos. hard
DATE 8/12/04 SUB STORE Basement
PLEASE ORDER THE ABOVE F.P. Best ORDER SUP'T
THE IRON TRADE REVIEW

FIG. 4.—THE ORIGINAL IS 3 X 5 IN., PRINTED IN RED.

specified on a form, Fig. 1, with which is filed an index on plain cards.

The materials for conversion into standard product are numbered, specified and indexed in the same way.

A list of authorized suppliers and contractors is filed on cards.

The minimum stock notice, Fig. 2, from the raw stock room initiates a purchase by drawing attention to the fact that

the item, carried on perpetual inventory, has reached the permissible minimum.

The quotation record, Fig. 3, is used to record the existing terms of purchase or those obtained on inquiry.

The purchase requisition, Fig. 4, is now filled and then the purchasing order, Fig. 5, in triplicate is filled out, two copies

WYCKOFF, SEAMANS & BENEDICT,
ILION, N.Y.

ORDER NO. 16528
DATE Aug. 12th, 1904.

MESSRS. Coe Brass Mfg. Co.,
Torrington, Conn.

PLEASE ENTER OUR ORDER FOR THE FOLLOWING, SUBJECT TO YOUR WRITTEN ACCEPTANCE BY Sept. 1st
UNDER THE CONDITIONS SPECIFIED BELOW:

ITEM NO.	NUMBER OR QUANTITY	NAME AND SPECIFICATIONS	UNIT PRICE	TO BE SHIPPED NOT LATER THAN
1	375 lbs.	.058" x 3-1/8" x 48" German Silver, 2 Nos. hard.	60¢ lb. 50-10-5%	9/1

PRICES ARE F.O.B. Ilion SHIP VIA N. Y. C. freight.
UNLESS MODIFICATIONS ARE AGREED TO IN WRITING BY THE UNDERSIGNED, ALL DELIVERIES MUST COMPLY STRICTLY WITH THE TERMS OF THIS ORDER. EXCESS SHIPMENTS OR SUBSTITUTED ARTICLES WILL BE REJECTED.
OUR ORDER NUMBER, AS GIVEN ABOVE, TO BE MARKED ON INVOICE AND SHIPMENT. INVOICES LACKING THE ORDER NUMBERS WILL BE RETURNED FOR CORRECTION.
THE CONTEMPLATED DATE FOR SHIPPING EACH ITEM IS TO BE SPECIFIED WHEN THE ORDER IS ACCEPTED. A BLANK ACCEPTANCE (WITH DUPLICATE COPY FOR YOUR FILE) IS INCLOSED.
WYCKOFF, SEAMANS & BENEDICT, PER F P Best R. ORDER SUPERINTENDENT

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FIG. 5.—THE ORIGINAL IS 11 X 8½ IN., PRINTED IN RED.

for record files and the original mailed to the supplier with the purchasing order acknowledgment, Fig. 6, which is duly returned.

The purchasing order history card, Fig. 7, is filled out and the particulars of the steps taken to forward the goods are added as occasion demands.

The stores received note, Fig. 8, is transmitted from the raw material stores by the receiving clerk immediately upon delivery of the goods, and the stores rejected note, Fig. 9, follows it where the raw material inspector certifies any portion not up to specification.

MESSRS. WYCKOFF, SEAMANS & BENEDICT,
ILION, N.Y.

GENTLEMEN:
WE HEREBY ACCEPT YOUR ORDER NO _____ UNDER THE CONDITIONS THEREON STATED. WE EXPECT TO MAKE SHIPMENT AS FOLLOWS:

ITEM NO.	DATE	ITEM NO.	DATE

THE IRON TRADE REVIEW

FIG. 6.—THE ORIGINAL IS 5½ X 8½ IN.

The transportation charges note, Fig. 10, is used to record express payments on goods. Railroad charges being recorded on the stores received note, Fig. 8.

A record of invoices received is kept on ordinary cards as well as a record of invoices approved for payment, while the payment voucher record, Fig. 11, contains an abstract of the amount and terms of each settlement with any individual supplier.

Storing of Raw Stock and Manufactured Supplies.

The goods are kept in a semibasement store, 300 x 55 ft., in regularly arranged spaces and bins convenient to the departments originating the productive work.

The bin card, Fig. 14, printed on both sides, is established for every one of 2,000 items used for manufacture and gives at any moment the "stock in hand." Maximum and minimum quantities are fixed and the raw material issue requisition, Fig. 12, is sent from the stock room to start material to the originating department. While costing any particular product the money value column is used.

The factory supply issue requisition, Fig. 13, is sent to furnish or renew any consumable factory supplies.

A perpetual inventory on the form seen in Fig. 14 and printed on both sides, is abstracted weekly from the raw stock bin cards and kept in a vault for reference. In case of destructive fire an accurate record of the raw stock up to within a few days is preserved.

Production Orders to the Factory.

It having been decided by the management to carry a stock of finished components on a certain maximum, normal and minimum basis carefully estimated with the departmental

capacity in view of each of 2,000 distinct parts, these, in a well oiled condition, are accommodated in a central stock room, 150 x 60 ft. Special cabinets, all of unit dimensions, are divided to suit the size and nature of the components and each compartment has always in a visible position a record of the stock contained in it. The forms used in this section are described in the order in which they operate.

STOCK NUMBER 214R NAME German Silver
ORDER NUMBER 16528 ORDERED FROM Coe Brass Mfg. Co.

DATE ORDERED	QUANTITY	NET PRICE	F.O.B.	UNIT PRICE
8/12/04	375 lbs	94 91	Ilion	50 lbs 50 10 50 %

DATE WANTED	DATE PROMISED	DATE INVOICED	DATE DUE	DATE DELIVERED	QUAN. ACCEPTED
9/1	8/28	8/27	9/7	9/6	370 lbs.

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FIG. 7.—THE ORIGINAL IS 3 X 5 IN., PRINTED IN RED.

The bin card, Fig. 14, printed on both sides, records a perpetual inventory of the finished stock on hand. A weekly abstract of this inventory is posted on the same form for each part and is kept in a vault.

The minimum stock notice form—(a card which in size and entries is similar to Fig. 2, but has spaces for entries showing the number on hand, the normal quantity, the maximum and the minimum number of parts allowed in stock)—is sent to the stock clerk whenever the stock on hand equals the minimum allowed, at which stage according to the routine card (3 x 5 in. plain) which contains for each piece the most economical and expeditious order of operations. A sample routine card, No. 214, refers to the line space gauge and the movements of the piece in this order: Store, punch, polish, stock.

RECEIVED ON ORDER NUMBER 16528 FROM Torrington, Conn.
VIA N.Y.C. CAR NO. 80132 CHARGES PAID Pd.

STOCK NUMBER	NAME	NO. OR QUANTITY	GROSS WEIGHT
214R	.058" x 3/8" x 48" German Silver, 2 no. hard	1 case 370 lbs.	390

NO. 3097 DATE 9/6 Kerr REC. CLERK

THE IRON TRADE REVIEW

FIG. 8.—THE ORIGINAL IS 3 X 5 IN., PRINTED IN RED.

STOCK NUMBER 91053-S NAME Chapmans Chaser 3/16" square
ORDER NUMBER 16610 SHIPPED BY Chapman & Co.

QUANTITY DUE	QUANTITY INVOICED	QUANTITY DELIVERED	QUANTITY ACCEPTED	STORES REC NOTE NO.
10 lbs.	13 lbs	13 lbs	0	2860

REASONS FOR REJECTION

These bars are 10 ft long instead of 4 ft. as per order

NUMBER 10 DATE 8/24/04 H. M. Hanks INSPECTOR

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FIG. 9.—THE ORIGINAL IS 3 X 5 IN., PRINTED IN RED.

The production order record, Fig. 15, is issued for a renewal of the component and data entered on the bin card Fig. 14.

The component issue requisition, Fig. 16, is filled out if the finished stock in question is prepared by compounding simpler pieces already made. While costing compound parts the money column is used.

Production order tags, Fig. 17, accompany each order in such numbers as to divide the flow of work into convenient quantities. These are wired to the material or its receptacle throughout the whole factory operations and record routine and progress.

NO. 20 DATE Sept. 9, 1904
American EXPRESS CO.
HAS DELIVERED THE FOLLOWING, ON WHICH TRANSPORTATION CHARGES ARE DUE:

AMOUNT DUE	.60
NO. OF PIECES REC. ARTICLE	1644

Reid Kerr REC. CLERK

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FIG. 10.—THE ORIGINAL IS 3 X 5 IN., PRINTED IN RED.

The repair order tag covers extra work required for repairing damaged pieces, and is printed on red stock but in other respects is similar to the form illustrated in Fig. 17. Both the red tag and the white one, Fig. 17, have printed on the back the notice shown by Fig. 18.

NAME Coe Brass Mfg. Co.
ADDRESS Torrington, Conn.

DATE OF INVOICE	AMOUNT	TOTAL	DEDUCTIONS FRT.	CONTRA.	DIS.	NET	CHECK NO.	DATE
8/27	94 91				09	94 82	1688	Sept. 5th. 1904

N. S. A. L. D.

THE IRON TRADE REVIEW

FIG. 11.—THE ORIGINAL IS 3 X 5 IN.

A perpetual inventory of components in process of manufacture printed on both sides, is kept in the stock room. This form is similar to Fig. 14 but has headings for the part number and name and the department. The quantity in hand in any one shop is at once ascertainable by the inspector. The course to be taken to vary the production in any desired manner is at once clear. This record is a duplicate of the one which is maintained in each operating department and is posted from the latter every morning.

PRODUCTION ORDER NO. 3230 FOR MANUFACTURE OF PART NUMBER 214
DATE 9/22/04 PLEASE ISSUE THE FOLLOWING MATERIAL:

QUANTITY TOTAL	QUANTITY DAILY	STOCK NO.	NAME	MONEY VALUE
120	lbs	214R	.058" x 3/8" German Silver	

DELIVER TO PUNCH DEPT. F. P. Best ORDER SUP'T

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FIG. 12.—THE ORIGINAL IS 3 X 5 IN., PRINTED IN RED.

Production Orders in the Factory.

The production orders are handled in the following way: If the department is an originating one, the tag order with the full routine, as in Fig. 17, and the raw material, are delivered from the stores and, immediately before the work

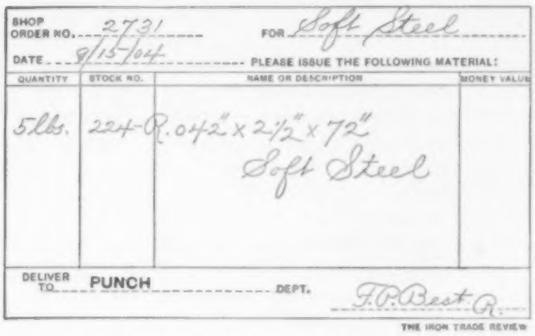

SHOP ORDER NO. 2731 FOR Soft Steel
DATE 9/15/04 PLEASE ISSUE THE FOLLOWING MATERIAL:
QUANTITY
STOCK NO.
NAME OR DESCRIPTION
MONEY VALUE
5lbs. 224-R .042" x 2½" x 72" Soft Steel
DELIVER TO PUNCH DEPT. F.P.Best R.
THE IRON TRADE REVIEW

FIG. 13.—THE ORIGINAL IS A 3 X 5-IN. RED CARD.

is put in hand, the order is recorded on the perpetual inventory card of components in process.

When any quantity of the component goes *out* of the department it is entered in the place provided on the card and the balance, or parts in process in the department, is always on record.

The production tag order, Fig. 17, amended as to count

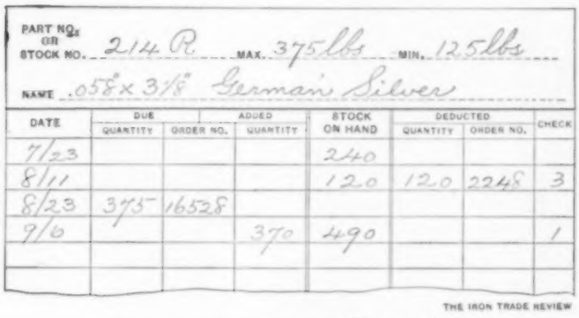


FIG. 14.—THE ORIGINAL IS 8½ X 5½ IN.

by the inspector for any rejected, spoiled or wrecked pieces, goes forward with the parts to the next department on the routine where it is similarly dealt with and finally reaches the stock bins and is added to the finished parts perpetual inventory there—see Fig. 14 already described.

An abstract on the form shown in Fig. 14 of the above

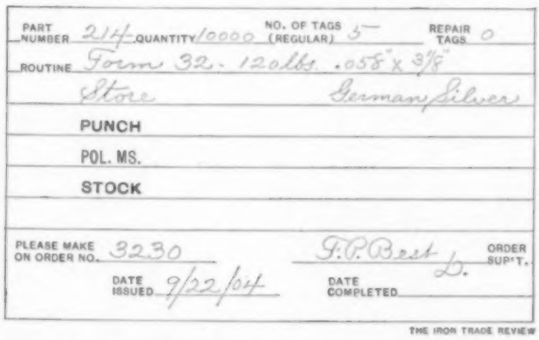

PART NUMBER 214 QUANTITY 10000 NO. OF TAGS (REGULAR) 5 REPAIR TAGS 0
ROUTINE Form 32. 120lbs .058" x 3⅛"
Store German Silver
PUNCH
POL. MS.
STOCK
PLEASE MAKE ON ORDER NO. 3230 F.P.Best L. ORDER SUP'T.
DATE ISSUED 9/22/04 DATE COMPLETED
THE IRON TRADE REVIEW

FIG. 15.—THE ORIGINAL CARD IS BLUE AND 3 X 5 IN.

index is posted weekly for every part in every department and is kept in a vault. Abstracts of the raw material, of every piece of work in process throughout the factory and of all the finished components and finished product are made weekly, with very slight cost, from the detailed inventories daily in use and are stored where they cannot be affected by fire.

In the system just described of purchasing, storing raw material, issuing same with production orders exactly as the

PRODUCTION ORDER NO. 3197 FOR MANUFACTURE OF PART NUMBER 537
DATE 9/21/04 PLEASE ISSUE THE FOLLOWING MATERIAL:
MONEY VALUE
ISSUED BY
PART NUMBER
QUANTITY
10000 214 1
10000 215 1
DELIVER TO ASSEM DEPT. F.P.Best D. ORDER SUP'T.
THE IRON TRADE REVIEW

FIG. 16.—THE ORIGINAL IS 3 X 5 IN.

flow of work demands, tracing production with accuracy and stocking and inventory of resulting finished components, nothing is left to memory, nothing is approximated, and any fluctuation up or down in demand upon the factory makes itself

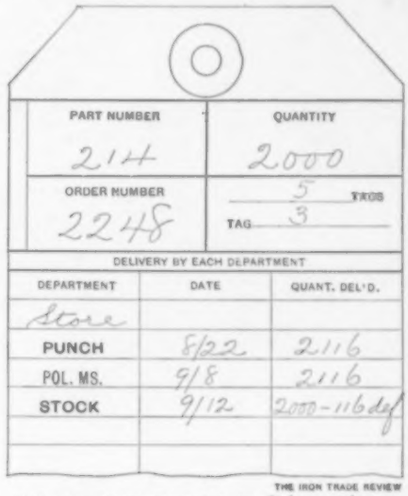


FIG. 17.—THE ORIGINAL IS 6¼ X 3⅛ IN.

felt timously and automatically in all the departments concerned. The system leaves the foremen and assistant foremen entirely free from clerical work, which is not their allotted function. The clerks—one stationed in each large

THIS TAG TO BE WIRED TO THE MATERIAL, OR TO THE RECEPTACLE CONTAINING IT, AND TO REMAIN ATTACHED IN ITS PASSAGE THROUGH THE SHOP.

ALL DELIVERIES BETWEEN DEPARTMENTS MUST BE ACCOMPANIED BY THE TAG. NO PARTIAL DELIVERIES TO BE MADE.

THE ENTRIES CALLED FOR ON THIS TAG ARE TO BE MADE BY THE DEPARTMENT CLERK BEFORE FORWARDING THE MATERIAL.

WHEN THE FINISHED PIECE IS RECEIVED AT THE STOCK ROOM THE STOCK CLERK WILL REMOVE THE TAG AND SEND IT TO THE STOCK DEPARTMENT OFFICE. HE WILL ALSO RECORD ON THE BIN CARD THE NUMBER OF PIECES RECEIVED.

FIG. 18.—NOTICE ON BACK OF PRODUCTION AND REPAIR ORDER TAGS.

department—are under the control of the stock room and form a valuable link between the department, the stock room and the system of general and departmental inspection.

THE ADAMS-FARWELL MOTOR.

The Adams Co., of Dubuque, Ia., has brought out a revolving cylinder, air-cooled, gasoline motor which is claimed to have the advantages of compactness, perfect balance, light weight, wide range of speeds and power and practical air-cooling qualities under all conditions. It reverses the ordinary practice, in that the engine cylinders revolve and the crank shaft is stationary. It is not what is usually termed a rotary engne. Three units, Figs. 1 and 2, each being a complete cylinder, with cylinder head and one-third of a central crank case cast in one piece, are bolted together and fastened to a top and bottom cast steel flange which has bronze bushings, forming bearings around the vertical stationary crank shaft. This forms the revolving unit and is, of course, balanced perfectly. This revolving unit in a 20 h. p. engine, with 5-in. bore and 4½-in. stroke weighs 190 lb. and forms the flywheel.

In each cylinder is a cast piston having four rings. The three pistons are connected to a single crank wrist pin of very large proportions by bronze pitmans. The wrist pin being eccentric with the axis of the revolving cylinder unit, the pistons are caused to reciprocate back and forth in the cylinder at each revolution of the rotating unit, although the mass of the pistons does not stop and return at each dead center as with the ordinary engine. It is, therefore, susceptible of a very satisfactory mechanical balance. The action of the exploding charge is practicaly the same in this engine as in the ordinary kind except for the smooth running caused by the variable compression control.

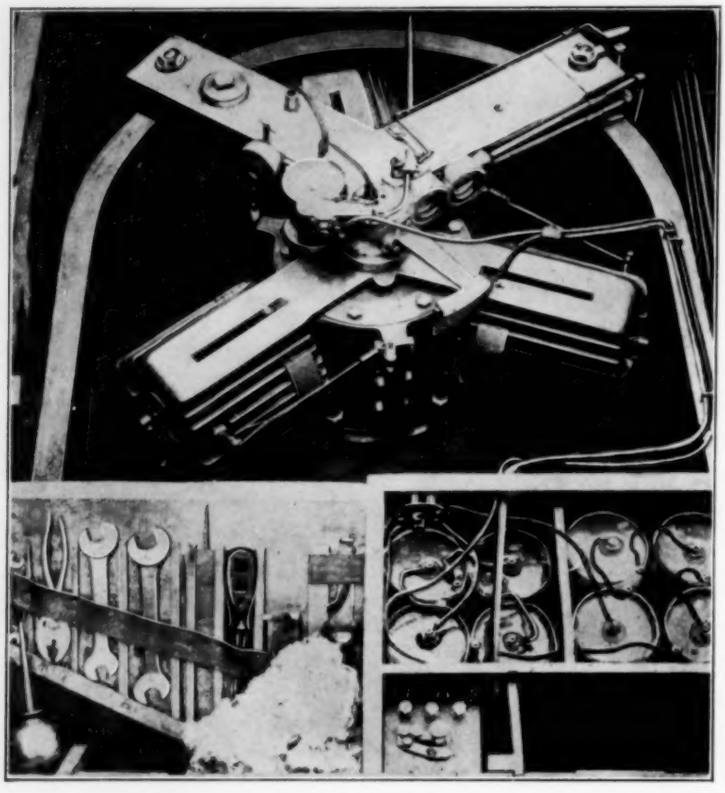


FIG. 1. THE ADAMS-FARWELL MOTOR APPLIED TO AUTOMOBILE PROPULSION.

A central crank case answers for all three cylinders. A single throw crank of about one-third the weight of the usual three throw crank is employed. A single valve operating cam opens both inlet and exhaust valves.

No muffler is employed. The velocity of the cylinders passing through the air renders a muffler of the ordinary type unnecessary. Auxiliary exhaust ports let out the high terminal pressure against the rapidly receding volume of air and the discharge cannot be heard when the engine is working at with less than full load. The auxiliary exhaust ports greatly reduce the pressure before the exhaust valve in the head of the cylinder is open. The gases that pass out of the exhaust valve are therefore comparatively cool. The valves are closed by centrifugal force. The higher the speed of the engine the greater the force, and the greater the need of a stiff spring or force to close the valve. The springs used are made of light piano wire and are useful only to close the valves in starting the engine where the centrifugal force at the slow starting speed might not be sufficient to overcome the resistance of cold lubricating oil on the valve stems. After the engine is slightly warmed every spring might be removed and the engine could be started and run.

Air cooling is accomplished by the cylinders revolving at a rapid rate, drawing in the air at the center and expelling it with great rapidity at ends of the cylinders. The cylinders are provided with longitudinal radiating ribs cast integral with the cylinders.

The speed of the motor is controlled by the variable compression system, allowing the surplus charge to escape backward by the inlet valve which is mechanically held open for a part of a compression stroke; that part of the charge so escaping being drawn in by another cylinder. There is no waste of the gases. When the maximum power is required the inlet valve is closed at the end of the suction stroke and the full charge is compressed to about 95 lb. per sq. in. When minimum power is wanted, the inlet valve is not closed until the completion of the compression stroke; an exceedingly small part of the charge is retained and ignited at asmospheric pressure.

The carburettor is automatic at all speeds. Gasoline is pumped through an upper pipe into a constant level reservoir which has a small cavity covered with a watch crystal for inspection of gasoline. The proportion of air and gasoline is always the same and the quality of the mixture constant but the quantity varies according to the power required and the position of the variable compression cam. The mixing valves are opened only after the sucking cylinder has drawn in that part of the charge which the compressing cylinder is blowing back by its inlet valve.

The spark is regulated automatically and fires the charge at all speeds at the point of greatest efficiency. This is a device employing a centrifugal governor which not only advances the spark when the speed of the engine increases but increases the length of the contact of the primary circuit. A contact of the primary circuit for 1-36 of a revolution of the engine gives sufficient time for the spark coil to become saturated and give a good spark when the engine is running 150 revolutions or less. This contact is automatically increased to about 1-12 of a revolution of the engine when running at 900 revolutions per minute. This is claimed to be a great saving of battery current and contact breaker points, for without this variable contact it is necessary to make the contact or the primary circuit long enough for the highest speed, therefore, using two or three times as much current when the engine is running low.

There is but one spark coil. The high tension current wire is connected to the commutator which is an insulated segment with a brass strip on the lower edge. On each cylinder there is a wire which leads from an insulator to the spark plug. A brass cap is adjusted to pass under the commutator strip without quite touching. As the cylinder that is at the time compressing approaches the dead center position the insulator passes under the commutator and the contact breaker breaks the primary circuit and a spark jumps the

gap, thence to the spark plug and into the cylinder. When the motor is started the spark is late and jumps the gap at the extreme right hand end of the commutator. As the speed of the motor increases the automatic spark regulator advances the spark and it jumps the gap further and further toward the left end of the commutator. The exact position of the spark can be seen while the motor is in motion.

The oiling of all parts of the motor proper is cared for by an automatic, positive feed oil pump. It consists of a circular barrel in which are four cam actuated plungers. The barrel is positively driven by a worm gear and there are no ratchets, springs or valves. The oil tank is located in the left end of the angular aluminum casting which forms a support to the upper end of the crank shaft. Being very close to the engine it is kept warm in the winter time, and the tubes leading from the pump are very short and not liable to be broken.

Fig. 1 is a view of the motor as situated in the rear of an automobile body. Fig. 2 shows a sectional view of the motor.

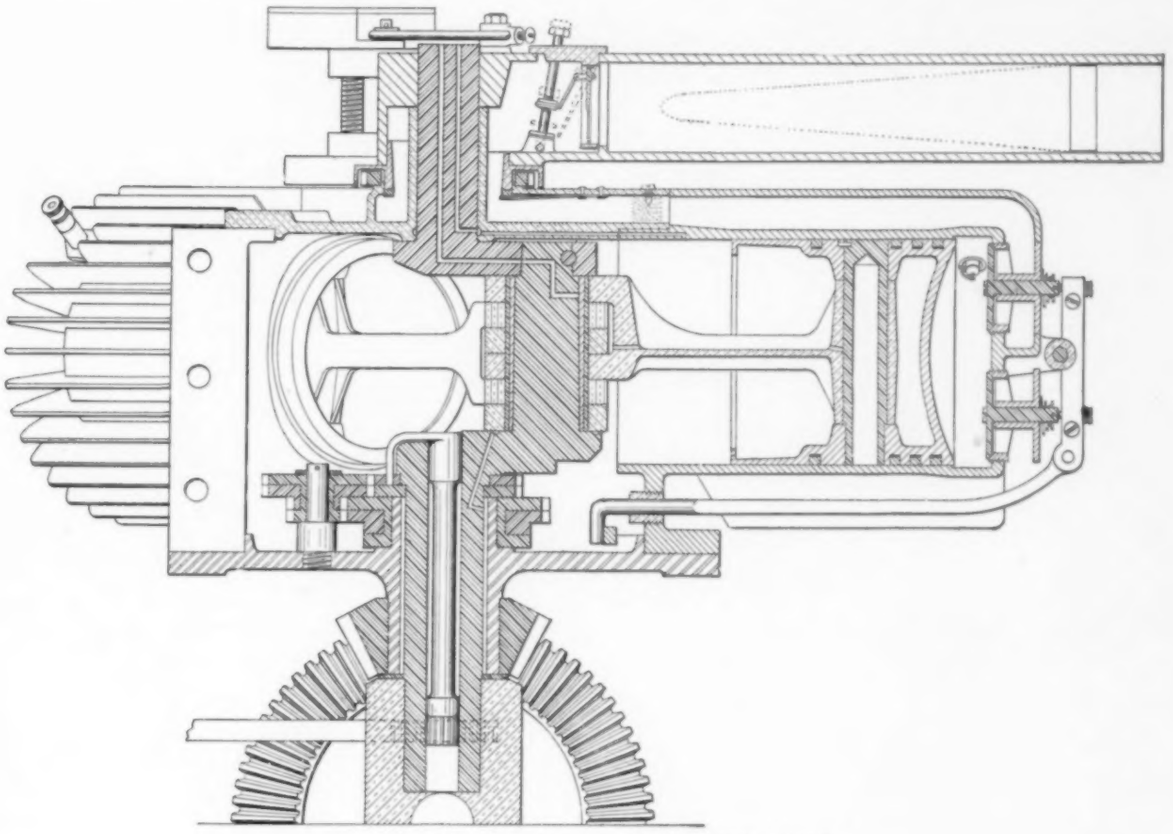


FIG. 2. VERTICAL SECTION THROUGH ADAMS-FARWELL MOTOR.

With no compression, the cylinders may be easily turned around, bringing any one in convenient position for removing spark plug or valves. All valves are duplicates. A cage forming the valve seat and guide for the valve stem is screwed into the head of the cylinders.

The complete plant, including all parts of the motor, transmission, all tank and pump, carburettor, clutch operating cams, etc., all secured to the bronze supporting spider, forms an integral power unit and weighs 387 lb. Of this 157 lb. is the transmission which would not be needed if the motor was used for other purposes than that of automobile propulsion. Of the 230 lb., the weight of the motor proper, 190 lb., are for the cylinders, etc. All motor and transmission bearings are bronze with steel shafts and the bearings are renewable. All the novel features: Rotating the cylinders around a vertical, stationary crank shaft, the muffling, control from front and rear seats, variable strength springs, carburettor, oiling system, etc., are the subjects of patents granted and pending in the United States and other countries.

Westinghouse Bond Issue.

The directors of the Westinghouse Electric & Mfg. Co. have decided to issue from time to time $15,000,000 5 percent 20-year debentures, redeemable on call at 105 and interest. It is the purpose of the management to provide for such an amount as may be needed from time to time to meet the demand for new electrical equipment which is deemed certain to come. Walter P. Uptegraff, closely connected with the affairs of the company, said: "The company proposes to issue $15,000,000 5 percent debentures for the purpose of preparing for the coming demand for electrical equipment for railroads now using steam, and for the equipment of the many electric roads being built. There is no doubt that in the near future this demand will be greater than the combined capacity of all the electrical companies in the world, and the Westinghouse Electric & Mfg. Co. proposes to be ready when that time comes. There will be many additions and betterments to the works, and better appliances for a rapid supply of the articles manufactured by this company. The money to come from the issue of these debentures will be used for that purpose and to secure a great portion of the new business which is bound to come."

Work has been resumed in the malleable iron foundry at the Champion Division of the International Harvester Co., Springfield, O., and a large force of men is at work in the reaper works. It is understood that the number of employes will be gradually increased until the shops are running in full force.

The Ore Unloading Plant of the American Steel and Wire Co.

The Central Furnaces of the American Steel & Wire Co. at Cleveland, comprise three stacks. Two of these are at present under reconstruction and, when completed, will be 90 x 22 ft. The third stack, which is in operation, is 100 x 20 ft. The total annual capacity of the three furnaces will be 495,000 tons.

The unloading machinery on the docks includes several different types. There are four McMyler conveying bridges, equipped with 1½-ton Hulett automatic buckets with an unloading capacity from vessel to railroad cars or to stockpile of about 600 tons each per day.

There are also seven King Bridge Co.'s conveying machines and two McMyler conveying machines, equipped with old style buckets having a capacity of about 500 tons each per day from vessel to car or to stock pile.

There are two McMyler whirlies, equipped with 1½-ton Hulett automatic buckets with a capacity of about 500 tons each per day.

This year there has been installed on the dock four Hoover & Mason machines, equipped with 5-ton automatic buckets with a capacity of about 1,250 tons each per day. These are designed and erected by Hoover & Mason, of Chicago, and are electrically operated throughout. They have electric scrapers similar to the installation at Toledo and are designed to remove the entire cargo mechanically. These machines can unload ore direct from the vessel into cars, into furnace bins, or on to stockpiles; they can also pick up ore from the stockpile and unload same into cars for shipment, or into the furnace bins. For the exact and rapid loading of cars direct from vessel each leg is provided with a 60-ton hopper having a roller exit. The illustrations show chutes suspended from the rear end of the bridges through which ore is delivered into the furnace bins or into cars. Owing to the crookedness of the river and the dock lines the machines are required to move freely around curves. This demanded a turntable construction of the front supports which is plainly shown in the illustration. The unloaders are anchored when at rest and moved when necessary by means of stationary wire cables which pass around spools on each machine, the spools being actuated by electric motors. The booms are so designed that they can be raised or lowered as desired. The overhang of the unloaders on the dock side is 52 ft., the total length of the bridge from the dock front to the rear is 260 ft. The whole mechanism is electrically driven with a 220 volt direct current and each unloader weighs about 300 tons when ready for work.

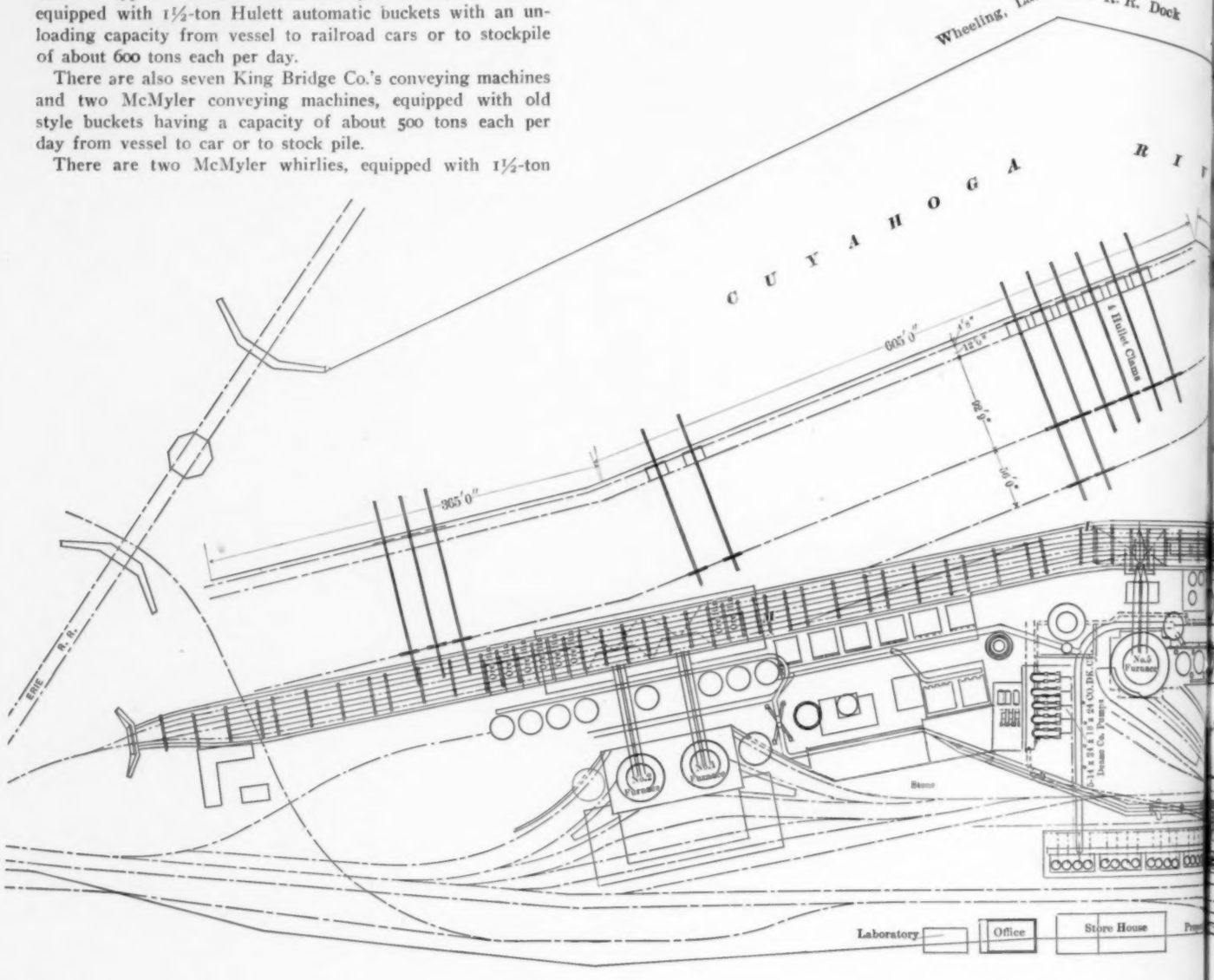


FIG. 1.—PLANT OF THE CENTRAL FURNACES OF

A DRAFTING ROOM SYSTEM.

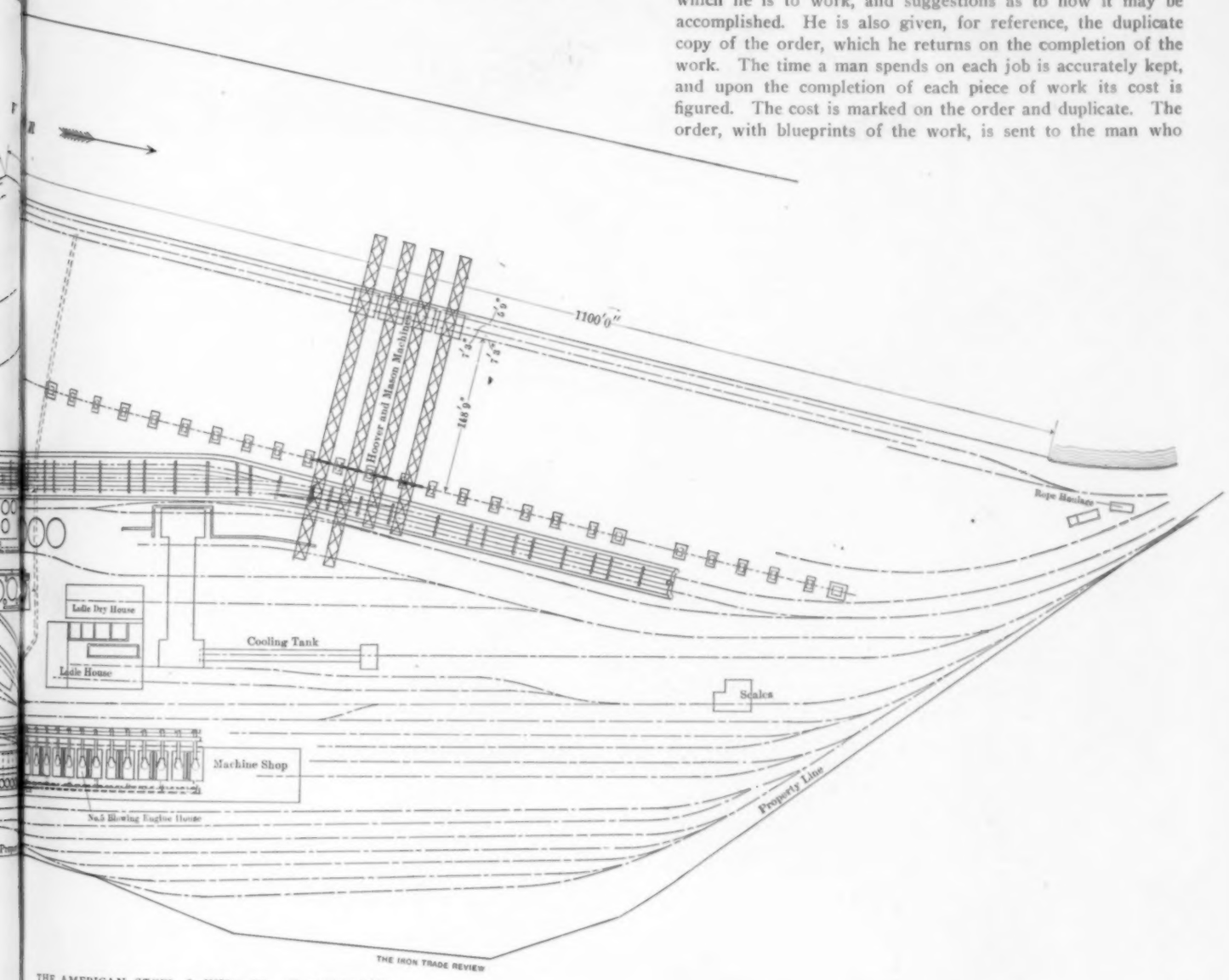
BY GEORGE A. WORDEN.

The value of the drafting room in a manufacturing plant, where the product does not depend directly on the work of the draftsman, is usually, I think, rather underestimated. There is not much doubt but that my views on this subject may be biased, but if a drafting room is worth having at all, why not have as good and efficient a one as possible. I don't believe that the conditions in any two offices are exactly the same, so naturally the systems must be different. The technical press now devotes considerable space to descriptions of different drafting room systems, and not infrequently some feeling seems to be aroused between the champions of different systems regarding which is the better, when, no doubt, either one would be a failure in the other office.

There are, perhaps, better systems for the office, but the one we are using now works nicely and gives very good satisfaction.

An order, with a duplicate, is written out either by the man desiring work done or by the chief draftsman, for every piece of work which comes into the office. On this order is a brief description of the work, and, if there be any rough sketches, they are attached to the duplicate order. On the order is also placed a time limit within which time the drafting room work must be completed. If the chief draftsman thinks that the time given is too short in which to complete the design, he communicates with the man who sent in the order to that effect. When the chief draftsman accepts the order he binds himself to complete the work within the time limit specified. The orders for work are filed away according to their importance and to the date when they are due to be completed.

When work is given to a draftsman it is explained to him fully—why it is to be done, what the newly designed apparatus is desired to accomplish, the difficulties with the present piece of apparatus, if there be one,—in short, the draftsman is briefly given all the available information on the subject on which he is to work, and suggestions as to how it may be accomplished. He is also given, for reference, the duplicate copy of the order, which he returns on the completion of the work. The time a man spends on each job is accurately kept, and upon the completion of each piece of work its cost is figured. The cost is marked on the order and duplicate. The order, with blueprints of the work, is sent to the man who ordered it, and the duplicate order is kept on file in the drafting room.



THE AMERICAN STEEL & WIRE CO. AT CLEVELAND.

This system may seem to call for considerable "red tape," but in operation it is really very simple, and enables the chief draftsman to know all the time just what a man is doing and how much his services are worth to the company. The cost records are always open to the draftsmen, and there is considerable good-natured competition among the men to keep their costs low and the volume of work they turn out large.

At the end of each week a complete list of the number of

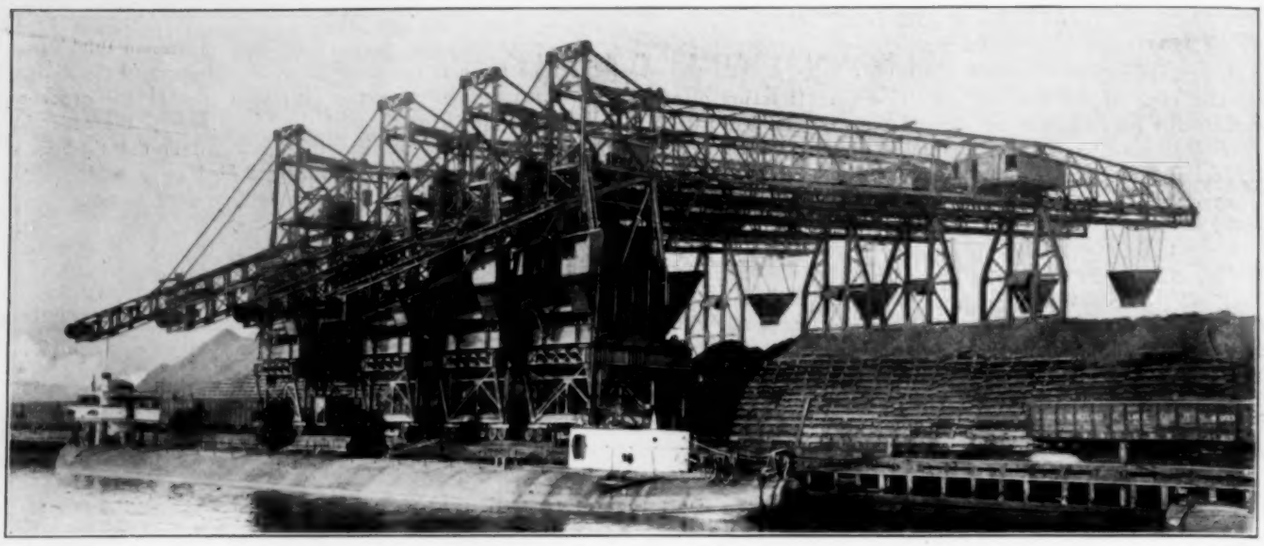


FIG. 2.—THE HOOVER AND MASON UNLOADERS.

jobs completed that week. with the cost of each, is sent to the chief engineer, so that, at a glance, he can tell the progress of work on hand and get an idea of the efficiency of the drafting room.

The next system which I will attempt to outline is that which has to do with the recording, indexing and filing of our blueprints and tracings.

At present we have on file in our vault about fifteen thousand blueprints, charged to us by another plant of the company; about three thousand "foreign" blueprints, or blueprints which are charged to us by outside concerns; five hundred of our own blueprints and eight hundred tracings.

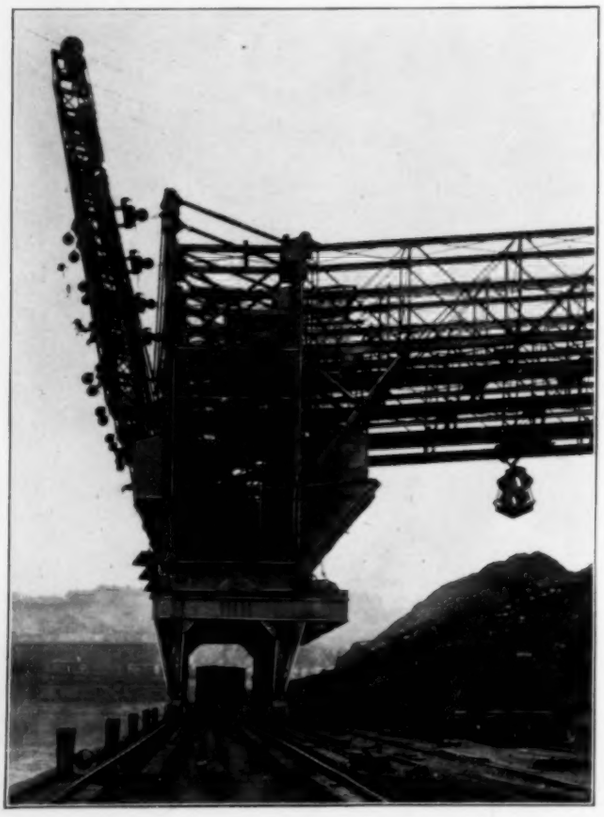


FIG. 3.—HOOVER AND MASON UNLOADER TRANSFERRING ORE FROM STOCKPILE TO CAR.

When a blueprint comes into the office it is tamped on the back with a regular receiving stamp, which gives the date. It is then recorded. It may be well to say here that we use the card index system throughout. A card is made out with the number of the print at the top, its date of receipt, date the blueprint was made, and the number of copies of this number received—all recorded in the proper spaces on this special card. There is also a space for record of prints which we may return, giving date of returning and number of copies. At the bottom of the card is left a space for the title of the blueprint. These cards are all filed away according to number, and serve as a numerical index to the prints.

The prints are now ready to be cross-indexed. Our index system has been built on the principle that a man without an especial knowledge of engineering or the works of the company would have no difficulty in finding a drawing of anything in the works which a man might ask for, or, in other words, all our drawings have been freely "cross-indexed."

We will say that the drawing we have to index is the design of a gas burner, used in the machine shop gas furnace. The cards, which are just plain index cards, with a space at the bottom left for the number of the drawing, would be made out as follows:

Burner, Machine Shop Gas Furnace.

Furnace, Burner for Machine Shop Gas.

Gas Furnace, Burner for Machine Shop.

In our index we make a main division which its subordinate indexes. This main division is arranged alphabetically, indicated by red spacer cards, and includes all general headings, such as Apparatus, Axles, Barns, Boiler House, Buildings, etc. Under each one of these headings there is another subordinate index arranged alphabetically, the same as the first, but indicated by buff spacer cards. For example, under the heading Buildings comes Blacksmith Shop, Boiler House, Machine Shop, etc. Under these headings comes still another index, indicated by blue spacers, as under Machine Shop we would find Cranes, Drill, Engine, Furnace, etc.

A subject like "Boiler House" would appear on a red spacer, and this would refer you to the proper place to find "Boiler House," namely, under "Buildings."

In finding the cards made out for the Machine Shop Furnace Burner, the first would go under the red spacer "Furnaces," under the buff spacer "Burners," and, were there enough cards under "Burners" to warrant would be placed under the blue spacer "Gas." The second card would be placed under the red spacer "Buildings," under the buff spacer "Machine Shop," and in its proper order alphabetically, there not

being enough furnaces in the "Machine Shop" to make a blue spacer for "Furnaces" necessary, under that heading. The third card would be made out as a red spacer, and on it would be a note referring you to "Furnaces."

This system really seems quite complicated to me as I write about it, but I assure you it is quite simple and without doubt one of the most efficient time saving devices in the office. I may add, in concluding the subject of indexes, that every blueprint, foreign as well as our own, and all our own tracings, are indexed under this system so that all our details of one thing, as sprockets, for instance, will appear in one place in the index, and we are able to tell at a glance just what sprockets, their number of teeth, pitch, etc., we have available for use without designing a new one. The tracings are all indexed before a print is made from them.

All the catalogues we receive are given a file number immediately upon their receipt, and are known by this file number according to their subject matter, and indexed similarly to the blueprints, only not so elaborately, of course. The catalogues are also indexed according to firms.

Our system of filing blueprints of all sorts, drawings and catalogues is the simplest possible. They are all arranged according to number, the prints charged to us from our other plant in one place, the foreign in another, our drawings and tracings—separate, of course—in another, all easily accessible. Ordinarily I should think it would be more advisable to have the blueprints, that is, foreign and domestic, filed together, numerically, and we would not separate them as we do but for the fact that we use our own blueprints so much more than the others, that it is a little easier to have them separate.

Every blueprint which leaves the office is charged out, and the man who desires the print must sign a receipt for it. This makes him responsible for it until it is returned to the office. These receipt cards are made in duplicate, the duplicate being filed separately and numerically, so that we can tell just what prints are out and where they are. The receipts proper are filed according to the names of the persons having the prints, thus enabling us to know how many and what prints each man has.

With this system we know all the time how many prints we have, their dates, "dates we received them or made them," where they are and all about them.

Our standards of bearings, fittings, etc., which are made up in book form, and of which each draftsman has a copy, involves another elaborate system for its maintenance, but I will not attempt to detail it here. We also have a bulletin board on which store stock, special details and other information of importance to the draftsman are kept.

While we try to have all the work in the office traced by the regular tracers, who do nothing else, yet occasionally work which is being rushed will be traced by the draftsman. Full rules for tracing, lettering, and dimensioning drawings are given in our regular office rules, so that all the work turned out in the office is uniform in style and general appearance.

Every office must have some system. Our system has to be exact, as the company is especially particular as to who knows about its designs, and it is very likely more detailed than is necessary with most plants, but in conclusion I can only repeat what I said before, that different conditions require different methods of operation and each problem must be worked out and mastered as it appears. That was the way our system grew up, and it is still growing.—[The Michigan Technic.

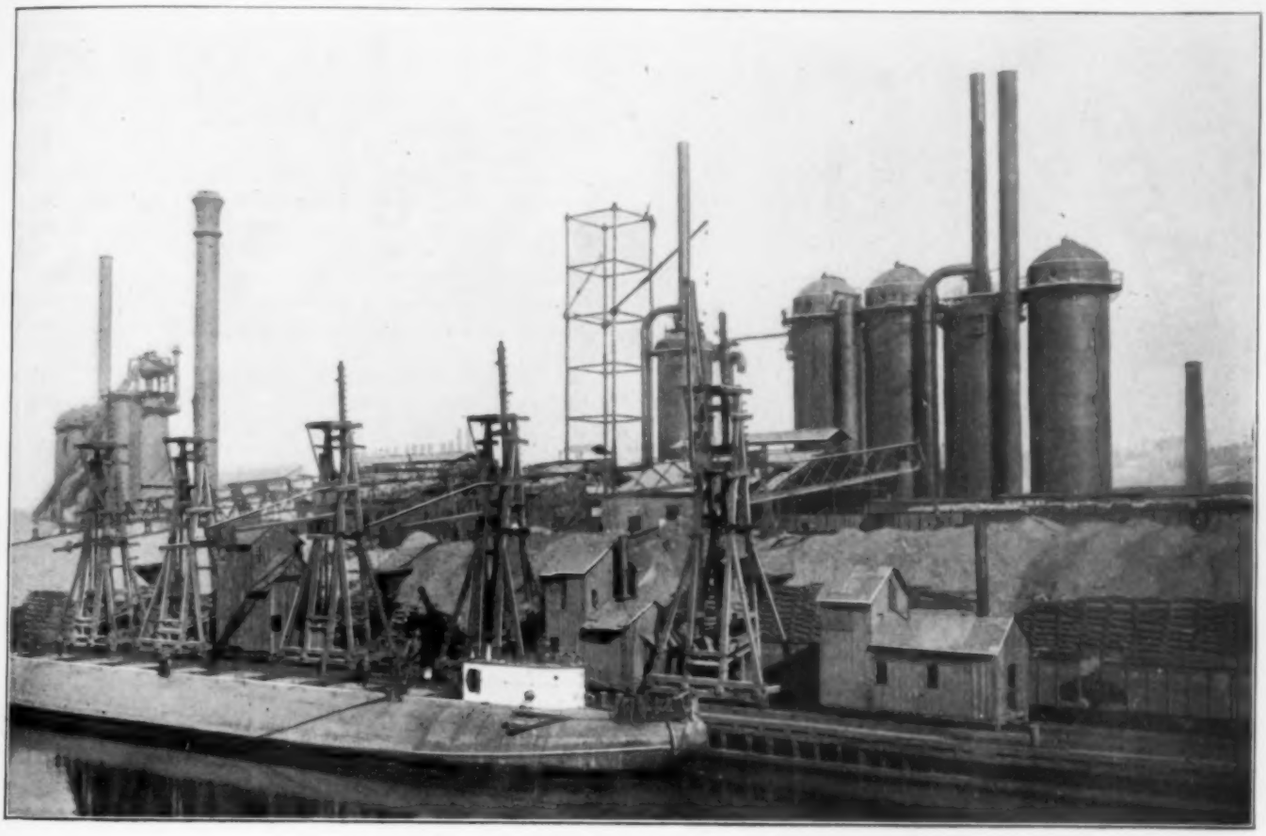


FIG. 4.—VIEW OF OLD TYPE UNLOADERS FROM THE ERIE R. R. BRIDGE.

Isaac N. Perry, formerly president of the National Bank of North America, Chicago, has been charged with arson. The allegation is that Mr. Perry set fire to the plant of the Chicago Car & Locomotive Co. at Hegewisch, Ill., Oct. 9. The evidence strongly supports the theory of incendiary origin. Mr. Perry denies the charge. He has resigned the bank presidency.

VERTICAL COMPOUND TWO-STAGE COMPRESSOR.

The reasoning determining the design of this compressor included compactness, saving in floor space and foundations, elimination of wear due to gravity at an angle to line of motion, a proper relation of crank and fly wheel effort, unobstructed access to all parts, an improved cooling system and as nearly as possible a self-contained machine.

The vertical design fulfils several of these requirements. A bedplate with sufficient stability to be practically independent of its foundations and bearing the complete mechanism meets other stipulations. The only objections that can be urged against it are height and that the attendant has to mount a stair to go his rounds. Against the first objection, of course, is to be set saving in floor space and foundations and the second has no sound basis and is not a real but imaginary

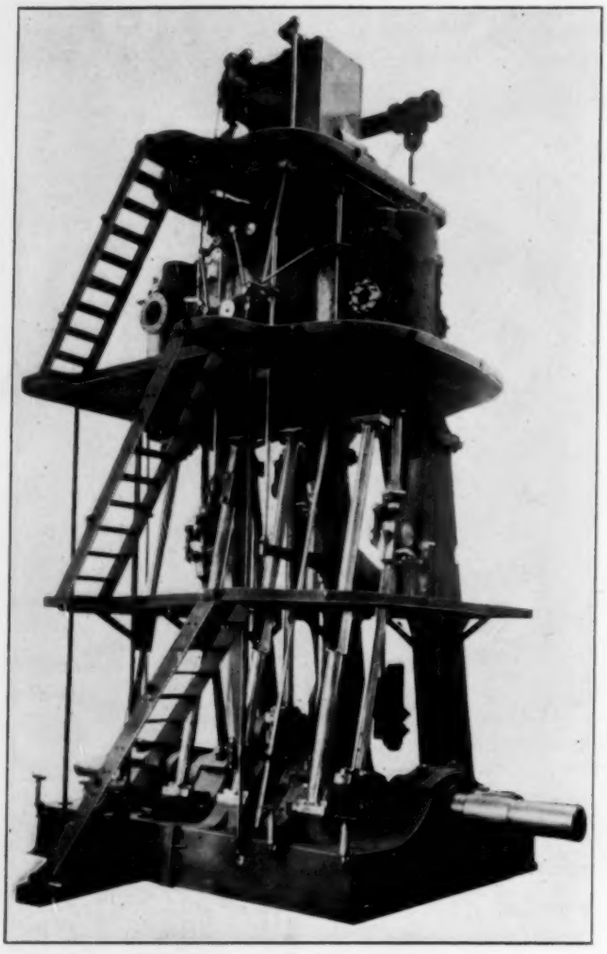


FIG. 1.—COMPOUND, TWO-STAGE, COMPRESSOR.

inconvenience. The actual manipulation in starting and stoping can be done from the floor and the labor of climbing a stair is not to be set against the advantages gained. In the design under consideration, lateral wear in cylinders and stuffing boxes is of course entirely eliminated and the alignment is undisturbed. Even the air valves are free from all wear except that inseparable from contact with their seats and this is in the line of motion and takes itself up indefinitely.

The whole machine, with all its working parts, can be seen at a glance; there is nothing out of sight or under the floor, the complete mechanism is in full view at all times.

The prominent features of the design are simplicity and the liberality with which all wearing surfaces are treated. The crank shaft is of the built up type; the air cranks outside and the steam crank in the center. The air cranks are 180 degrees apart, with the steam crank 90 degrees from each; the steam crank during the period of compression is in position to fully utilize the steam effort and a minimum weight of fly wheel suffices for steady movement.

Lubrication of the main journals is forced by special cups feeding solid lubricant to the under side of the bearing.

The steam valve gear presents in itself no novel features, being of the double eccentric Corliss type, the high pressure fitted with releasing gear. The governing, however, is very simple. A small piston working in a vertical cylinder is loaded with a weight equal to the air pressure acting under the piston and connected to the knock-off cams of the high pressure gear. When the air pressure exceeds the load on the piston its upward movement changes the cutoff regulating the speed to a point equal to the demand. The air valves, together with the cooling system, are the results of long experiment. The low pressure air inlet valve is mechanical and of the ordinary semi-rotary or Corliss type as it has no function to perform except to open and close at predetermined intervals entirely independent of pressures. All other valves are of the poppet type operated entirely by the air pressures. Flat seats are used throughout. Any valve, with its seat and all component parts, can be removed entirely from the heads, examined and replaced or renewed in from five to ten minutes.

The high pressure suction valve has not a nut, setscrew, split pin or key in its construction and with the bonnet removed and the valve cage drawn out. the valve can be taken out of its guide and seat, replaced and secured in thirty seconds. The discharge valves are of nickel steel, as light as can be made and seat easily and quietly. The entire valve arrangement has had an experience of six years' actual use and the efficiency and cost of maintenance is found satisfactory.

In the usual arrangement of the cooling system the cooling water is admitted to the jacket at some convenient point and left to find its way out at some other convenient point regardless of proper circulation, the result is generally a cold belt extending from the inlet to the outlet openings with the remainder of the surface comparatively unaffected. In this design the cooling water is compelled to make the circuit of the cylinder three to four times depending upon the size of the cylinder and there are no pockets or dead spaces. The intercooler is of liberal proportions and easily cools the air to a point below its original temperature. The cooling water is handled preferably by a pump operated by the machine itself so that the volume of cooling water may bear a constant relation to the volume of air. The intercooler is placed in a vertical position, and the air and water cycles are as follows: Air from low-pressure cylinder to top of intercooler, from bottom of intercooler to high pressure air cylinder; water from pump to bottom of high pressure air jacket, from top of jacket to bottom of intercooler, from top of intercooler to bottom of low pressure air jacket, from top of low pressure jacket to overflow. It will be seen that both air and water travel in directions which would naturally result from their changing temperatures and with least possible effort. The total losses in the machine, including friction, leakages at valves and pistons, etc., amounts to only 5½ percent and furnishes ample justification for the design.

The machine illustrated has a capacity of 3,000 cu. ft. of free air per minute and some of the leading dimensions are: Steam cylinders, diameter 19 and 42-in.; air cylinders, diameters 34 and 19-in.; all cylinders, stroke 42-in.; fly wheels, weight, total, 30,000 lb.; fly wheels, diameter 14 ft.; floor space, 14 x 21½ ft.; height, total, 28ft.; weight, total, 220,000 lb.; crank shaft, diameter, 11½ in.; crank pins, diameter, 9½ in.; crank pins, length, 10 in.; air pressure, 120 lb.; steam pressure, 140 lb.; intercooler surface, 1,340 sq. ft.

Fig. 3 shows a section of the high pressure air cylinder and head illustrating valves, air and water passages. Beginning with the inlet valves it will be noted that by removing the

bonnet the valve, seat and all parts can be drawn out together or the individual parts separately. A is the air cylinder and B the head. The valve F has a neck formed at the outer end into which a split collar E is fitted. The sleeve D slips freely over this, securely locking it in place on the valve stem. This

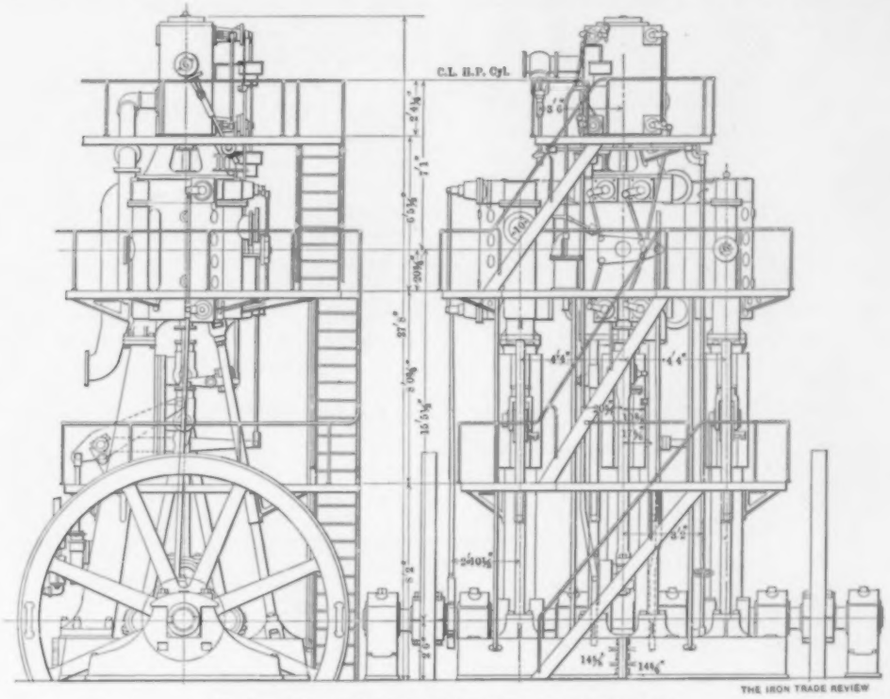


FIG. 2.—END AND SIDE ELEVATIONS OF COMPRESSOR.

split collar E forms the stop or shoulder for the spring G and thus avoids the use of any nuts, keys, set screws or other contrivances which may become loose and allow the valve to get adrift. The valve is lightened as shown by drilling the stem out and plugging the inner end. The cage or seat J is of forged steel and extends clear across head. On this

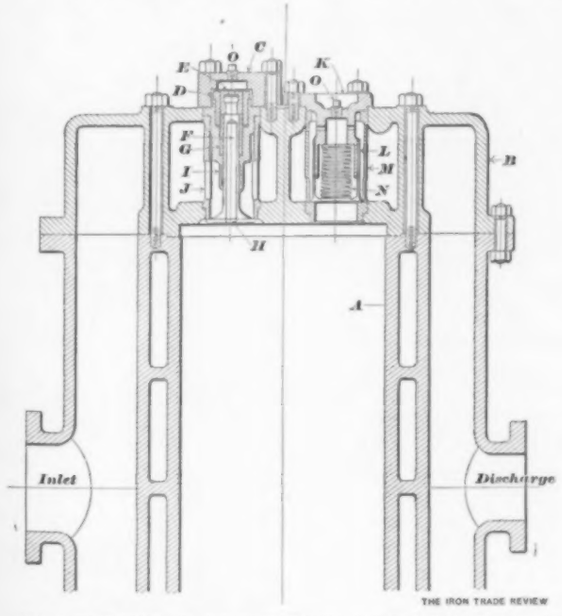


FIG. 3.—SECTION OF HIGH PRESSURE AIR CYLINDER HEAD.

rests the forged guide I and the whole is securely clamped in place by the bonnet C. By removing the plug O the action of the valve can be observed at any time by inserting a bit of wire. The delivery valve cage M is arranged in the same manner and held in place by the bonnet K which also forms the guide for the cup shaped valve L and the pocket for the spring N. Extreme lightness reduces the momentum in seating and permits a light and elastic spring and to that end they are made of nickel steel and the section reduced to a point that would ordinarily seam ridiculous but as a matter of fact they have not shown a single failure. The form of discharge valve and guide leads to a very satisfactory dash pot action practically relieving the spring of shock in opening and assisting in an easy closure. The arrangement of valve is peculiar to this design and is believed to be an improvement.

Fig. 4 shows a section through valves of low pressure air cylinder. A is the air cylinder, B the cylinder head, C the valve. The discharge valve bonnet, cage and spring are indicated by D, E, F and G. H is the plug, I the piston and J the water jacket.

Fig. 5 shows connecting rods complete and in detail, the

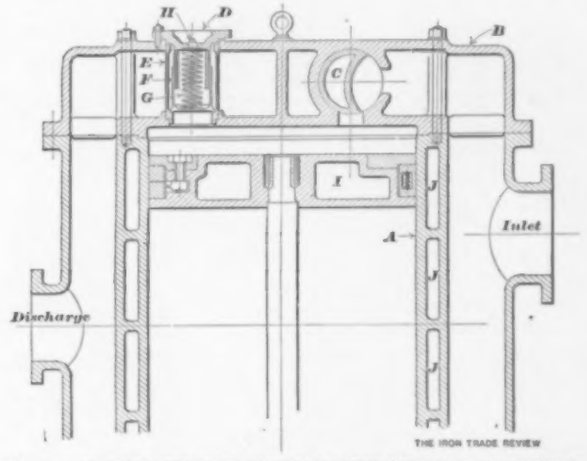


FIG. 4.—SECTION THROUGH VALVES OF LOW PRESSURE AIR CYLINDER.

crank end boxes are of steel and the upper end boxes of bronze both lined with hard babbitt. The upper wedge gives a full bearing under box at all times, the crank end needs no detailed description. It is simply a genuine marine end, in

fact the entire rod is taken bodily from a marine engine design from which scores of large marine engines have been built. The steam crosshead is identical with the air crossheads except that the latter are of course threaded to the piston rods instead of keyed, in order to preserve clearance adjustment. The pin is taper fitted to crosshead and secured by a collar nut. A comb at the rear is the only oiling arrangement required and dips into an oil trough at bottom end of stroke, carrying the oil up over the slide face on the up stroke. Cups on the front are for the two connecting rod ends, one oiling through the upper butt above the pin and the other having a drip to a cup on rod. All fits are ground in and all crossheads are steel castings. This compressor is made by the Great Lakes Engineering Works of Detroit, Mich.

The Merit of the Chain Drive.

The following information is given by George Hill, of New York, in reference to high-speed chain driving as a means of transmitting power from electric motors to line shafting, counter shafts and individual machines and tools: Some two years ago I was rebuilding the Vulcanized Rubber Co.'s works at Morrisville, Pa., with the idea of using motor drives in practically every case, with the exception of the main line shaft. The main shaft in the old mill was formerly driven by spur gearing direct from the engine, as a positive drive was desirable, but this method of connecting to the line shaft was objectionable in the new mill on account of the noise made by the gears, because we wanted clear alleys on each side of the rubber rolls and finally wished to group all of our engines in one engine room.

The new design called for two independent 200 h. p. Corliss engines arranged to drive to a jack shaft, and a second drive from the jack shaft to the main line, one engine to be a relay in case of breakdown or need of repairs.

To drive through belting while possible was hardly practicable. It was estimated that at least 24 ft. centers would be required, while according to the chain design these centers could be reduced to as short a distance as permitted by the engine construction. The reduced center distances incident to the use of the chain permitted of reducing the floor space in the engine room some 750 sq. ft., which amounted to a saving in the cost of this building of $1,000 with the difference in the cost of the chain and belt drive of about $500 in favor of the chain.

The high efficiency claimed by the makers, if sustained, would show a continuous saving in power consumption, and this, in connection with the less space required, decided me to use the Morse silent chain. The drive is from the engine direct to the jack shaft on 7 ft. centers, with the necessary sprocket wheels on a similar engine some ten feet away, so that these chains could be uncoupled and placed on the other sprocket wheels in case of a breakdown of the regular driving engine. The second transmission is from the jack shaft to the line shaft on 14 ft. centers, the total distance of the engine from the main shaft being about 20 ft. The speeds of these chains are about 1,150 ft. per minute, and they have required but little attention in the way of lubrication, and make practically no noise when running.

There are forty motor drives operating principally individual tools in connection with the work in the factory, though a number of them are used for blower and pump drives. The cost of the individual drives from the motor was much more than for leather belting, but the silent chain has a most decided advantage on account of the positive speed ratio obtained, less space required, higher efficiency and greater durability, making it the most desirable transmission to use. Loss of time repairing belts is a considerable item each year that costs in the delivery of an order frequently far more than the chains cost.

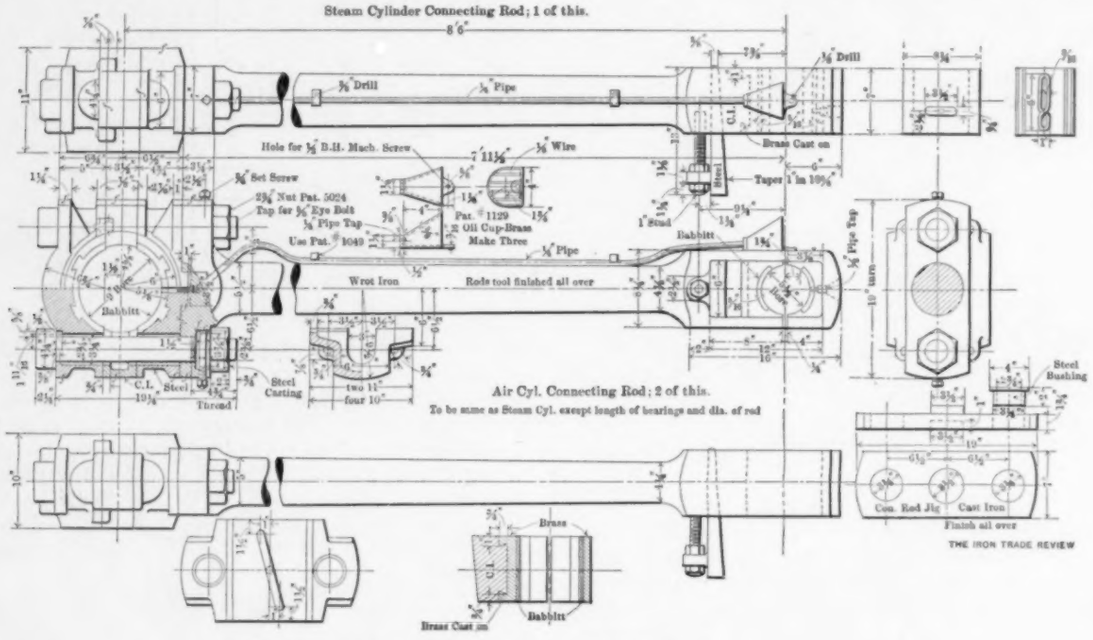

Steam Cylinder Connecting Rod; 1 of this.
8'6"
Air Cyl. Connecting Rod; 2 of this.
To be same as Steam Cyl. except length of bearings and dia. of rod
Rods tool finished all over
Wrot Iron
Babbitt
Brass
Steel Bushing
Con. Rod Jig
Cast Iron
Finish all over
THE IRON TRADE REVIEW

FIG. 5.—DETAILS OF CONNECTING RODS.

The works of the Federal Refractories Co. at Alexandria, Pa., are nearing completion. This plant is laid out to be one of the largest and most up-to-date in the country, located adjoining some of the largest flows of "Juniata" silica rock in Pennsylvania. It will soon be turning out silica and magnesite brick in large quantities. M. J. McEvoy, connected with the manufacture of "Reese" silica brick for the last 16 years, will have charge of manufacture. The new company will be ready to put magnesite and chrome brick on the market before Jan. 1. The Stowe-Fuller Co., of Cleveland, is back of this project, with its experience in the manufacture of high grade brick. W. N. McNight, of Pittsburg, will be manager and have charge of the sales of the Federal Refractories Co. Its plant is only the second in this country built for the manufacture of magnesite brick.

THE LANDIS BOLT CUTTER.

The Landis die has recently been patented and with a line of bolt cutting machinery is manufactured by the Landis Machine Co., of Waynesboro, Pa. The bolt cutter is the result of a long and careful study of the subject. The die is made up of four chasers of flat pieces of steel as shown in the engravings. The teeth are milled the entire length on the flat sides of the chasers. The milling is done with special machinery in order to insure the greatest accuracy. The throat is formed by beveling the front edge of the chasers. This gives a uniform shape and therefore the same results are obtained after each grinding. The tempering does not need repeating and the danger of cracking is thus avoided. The

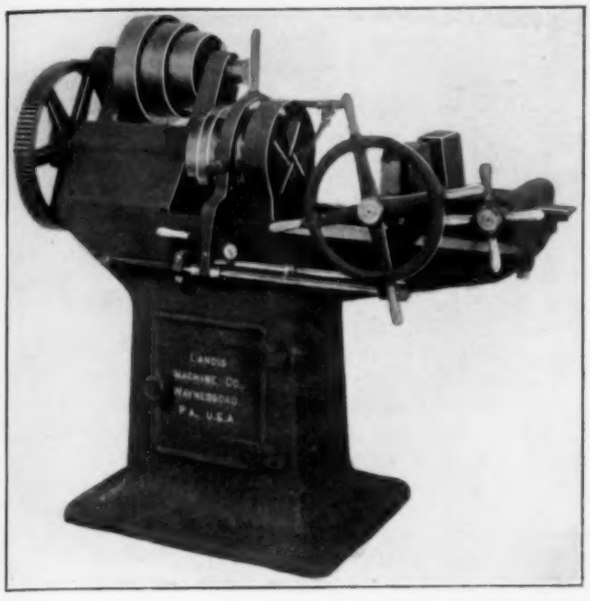


FIG. 1.—THE LANDIS BOLT CUTTER.

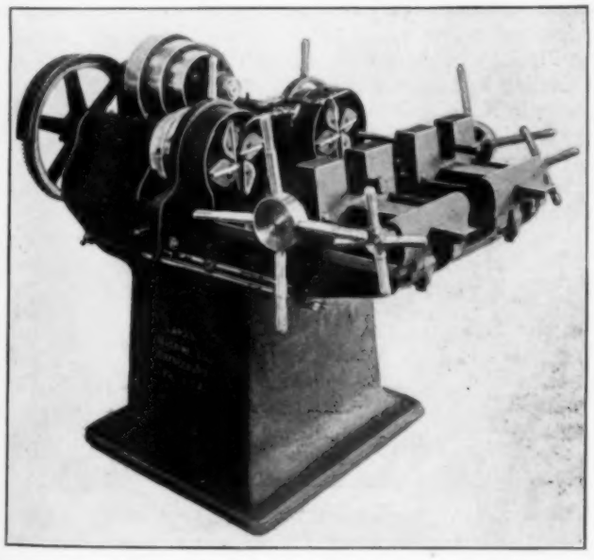


FIG. 2.—DUPLEX BOLT CUTTER WITH LANDIS DIES.

cutting is done on the ends of the chasers and the grinding is also done across the ends. This gives a long life as nearly the length of the chaser can be used.

Fig. 1 is the single head bolt cutting machine and Fig. 2 is the duplex bolt cutter. Fig. 3 shows the die head with one chaser removed to illustrate the fastenings, etc.

It will be seen that the chasers are cut on the side for their entire length. The ends are ground with the aid of a small fixture furnished with the machine and used in connection with any ordinary cutter grinder. The setting is accomplished by a gauge also furnished with the machine. The clearance in the die is ideal, the chasers stand on lines tangential to the bolt and on angles in agreement with the thread cut. The cutting is done by the front teeth, the back teeth do no cutting but take a bearing on the work a little back of the face of the cutters and thus form a permanent lead nut, which always remains the same, as the die is never ground in the throat. The chasers are held in grooved blocks, which are secured to the oscillating spindles. These spindles move simultaneously to open and close the die. As shown in the illustration of the die head, Fig. 3, the chasers stand out in front of the head and threads can be cut close up to the bolt shoulder, no projections being beyond the face of the die. The

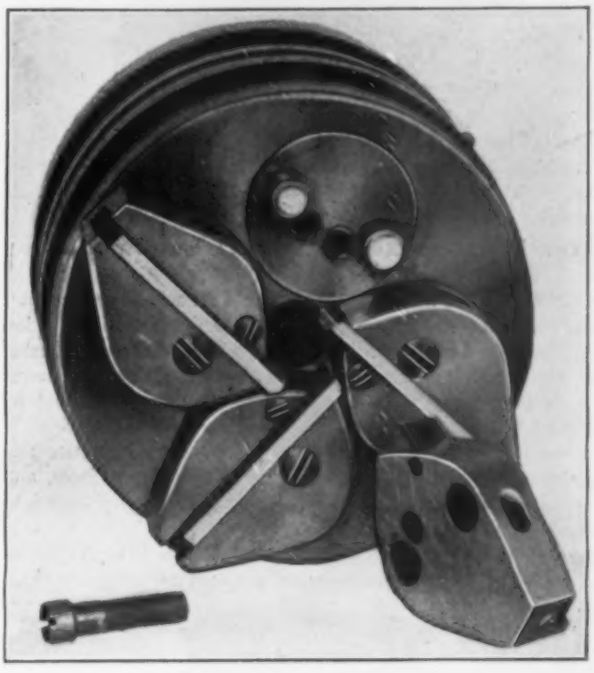


FIG. 3.—THE DIE HEAD WITH ONE CHASER REMOVED TO ILLUSTRATE FASTENINGS, ETC.

same set of chasers will cut either right or left hand threads by cutting on opposite ends and using different chaser holders. The cutters are interchangeable and can be replaced irrespective of the sets.

The adjustment of the die is simple. A screw follows up the chasers as they are ground off from time to time and they are held in position by a screw which engages the chaser threads. The chasers are adjusted to the size of bolt simultaneously in the head with a fine adjustment. The die opens automatically and closes with the return movement of the carriage. The head can be made to apply on other makes of machines when this is desired. Pipe dies of same type are also made.

The carriage vise has guides centralized over the work with clamping screw immediately below, eliminating side thrust. The rack is central of the machine and directly below the line of the bolt being cut. The pump is of the positive rotary type and the flow of oil is easily regulated. The oil tank with pan for ships is located inside the base of the machine whence it can be easily removed for emptying and cleaning.

The Lawrence Pump & Engine Co., Lawrence, Mass., recently incorporated, takes over the business of F. A. & P. Hall. The plant has been enlarged.

AN OIL AND WASTE SAVING MACHINE

The machine here illustrated is said to be capable of extracting 98 percent of the oil or grease from waste or any other fabric, in an easy, safe and economical manner, so that the cleaning waste and oil can be saved and used over and over again.

The oily waste is placed in a perforated metal basket which is surrounded by an outer casing. The basket is mounted on a vertical steel shaft, running in phosphor bronze

FIG. 1.—THE COMPLETE MACHINE FOR SAVING OIL AND WASTE.

bushings, and on ball bearing steps. Attached to the shaft and at the bottom of the basket is a series of turbine blades. A jet of live steam striking these blades causes the basket to revolve at the required speed, after which the exhaust steam passes into the basket, through the waste and out by way of an exhaust pipe.

The exhaust steam from the turbine heats the waste and liquefies the oil, which is extracted by centrifugal force, and runs out of the bottom of the machine, through a trap into any receptacle desired.

The complete separation of the oil and waste is accomplished in less than thirty minutes, with a steam consumption equal

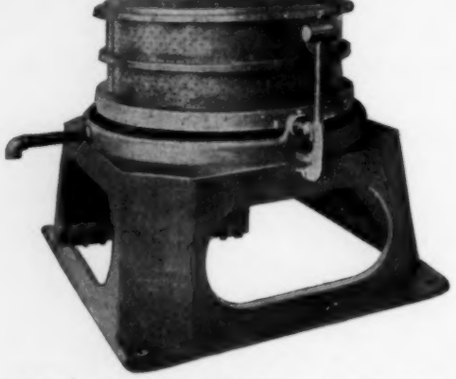


FIG. 2.—THE OIL AND WASTE SAVING MACHINE WITH CASING REMOVED.

to 15 lbs. of water on a machine with a 20-in. basket and 30 lbs. of water on a machine with 36-in. basket.

The machine is the invention of Thomas S. Patterson. It is designed and built for long and constant service, and has a vertical shaft running in a well of oil; it has no outside running gear, has no belts, pulleys and countershaft, no exposed parts, no stuffing boxes, and requires no attendance except the three minutes' time for loading and unloading.

The machine is said to be saving over 100 gallons of oil daily at the Brooklyn Rapid Transit power stations, 2nd street and 3rd avenue. It has reduced the consumption of waste in the 8,000-h. p. plant of the New York & Queens Light & Power Co. at Astoria, L. I., to one pound per day, and has also shown similar results with other stations.

The Oil and Waste Saving Machine Co. has been recently incorporated for the manufacture of these machines and has main offices and works at Rochester, N. Y., and New York offices at 170 Broadway.

ANNUAL MEETING OF THE A. S. M. E.

The list of officers to be voted for in the ensuing year as presented by the nominating committee of the American Society of Mechanical Engineers is as follows: For president, John R. Freeman, Providence, R. I.; for treasurer, Wm. H. Wiley, New York; for vice presidents—S. M. Vauclain, Philadelphia, H. H. Westinghouse, Pittsburg, Fred W. Taylor, Philadelphia; for managers—George M. Brill, Chicago, Fred J. Miller, New York, and Richard H. Rice, Lynn, Mass.

The following is the preliminary announcement of the order of proceedings at the coming annual meeting in New York. The headquarters will be at the Society house, No. 12 West Thirty-first street, and the opening session will occur on Tuesday, Dec. 6, at 9 p. m. President Ambrose Swasey will deliver the annual address, the subject being "Achievements of the Engineer with Respect to Exact Measurements." The second session will occur on Wednesday morning at the hall of Mendelssohn Union, 113 West Fortieth street, at 9:30 o'clock. This will be the business session of the convention and the following professional papers will also be presented: "A New Hydraulic Experiment," by A. F. Nagle; "A Twist Drill Dynamometer," by W. W. Bird and H. P. Fairfield; "Diamond Tools," by Gus C. Henning.

The third and fourth sessions will take place at Mendelssohn Union on Thursday. At the morning session the following professional papers will be considered: A. J. Bowie, Jr., "Centrifugal Fans;" Charles T. Main, "Computation of Values of Water Powers and Damages Caused by Diversion of Water Used for Power;" Chas. E. Sargent, "An Indicating Steam Meter;" Robert S. Hale, "Stay Bolts, Braces and Flat Surfaces; Rules and Formulae;" George I. Rockwood, "Condensers for Steam Turbines." At the afternoon session the professional papers will be as follows: "Bursting of Fourfoot Fly-Wheels," by Charles H. Benjamin; "Influence of the Connecting Rod upon Engine Forces," by Sanford A. Moss; "Losses in Non-Conducting Engines," by James B. Stanwood; "Power Plant of Tall Office Buildings," by Stirling H. Bunnell; "Pressures and Temperatures in Free Expansion," by A. Bordody and R. C. Cairncross (presented by Charles E. Lucke).

The closing session will be held at the Society house on Friday morning, Dec. 9, at 10 o'clock. Following are the professional papers that will be considered: "Fuel Consumption of Locomotives," by George R. Henderson; "Road Tests of Brooks Passenger Locomotives," by E. A. Hitchcock; "Discharge of Water with Steam from Water Tube Boilers," by A. Bement; "More Exact Method for Determining the Efficiency of Steam Generating Apparatus," by A. Bement; "Forcing Capacity of Fire Tube Boilers," by Francis W. Dean.

The sale of the Simonetta File Works, Detroit, set for Oct. 17, has been indefinitely postponed. The stockholders are now trying to make a new deal by which additional capital can be secured and operations resumed. They believe that the business will succeed if well managed.

The Valley Plate & Sheet Iron Co. is the name of a new company that has embarked in business at Niles, O. The company will do a general line of sheet metal work and make a specialty of steel barrels.

PERSONAL.

Edward C. Smith has been appointed sales agent of the Sloss-Sheffield Steel & Iron Co. in St. Louis territory. His office is at 506 Commonwealth Trust building. In this agency Mr. Smith succeeds the Field-Evans Co. with which he was connected as manager in St. Louis.

Kenneth Falconer has opened an office at 224 St. James street, Montreal, Can., and will act as local manager for Gunn, Richards & Co., of New York. Mr. Falconer has been an occasional contributor to *The Iron Trade Review* on factory systematizing and undertakes the installation of modern cost finding methods and other improvements in shop and office management.

Marcellus Reid, M. E., has opened an office at 1025 Citizens' building, Cleveland, and will be western representative of the Standard Machinery Co., of Providence, R. I. He will also design special machinery for machine shops and mills.

E. A. S. Clark, general manager of manufacturing of the International Harvester Co., who has been elected to the presidency of the Lackawanna Steel Co., Buffalo, vacant since the resignation of Walter Scranton last year, will assume his new duties Jan. 1.

It is believed that the election of C. S. Guthrie as a director of the Republic Iron & Steel Co. was in recognition of a considerable interest in that company held by the Moore brothers and their friends.

Geo. G. Blackwell, of Geo. G. Blackwell Sons & Co., Ltd., Liverpool, Eng., was prevented by illness from making the trip to the United States with the Iron and Steel Institute party. He has visited this country in the fall of the year for several years, and in lieu of this fall's trip will come over in the spring of 1905.

Rudolp Diesel, inventor of the Diesel engine, and general consulting engineer to the manufacturers at Munich, Germany, has been in the United States for some time. Returning to New York from the St. Louis exposition last week, he attended the meeting of the Iron and Steel Institute.

Andrew M. Morrison, formerly manager of the Edge Moor plant of the American Bridge Co., but more recently manager of the new Ambridge plant, has accepted a position with the Pennsylvania Steel Co., Steelton, Pa.

Ernest Wiener, of the firm of Arthur Koppel, 66 and 68 Broad street, New York, has just returned from a three months' trip to Europe. He reports that general business conditions in Germany are very good. While abroad he made arrangements which will enable him to furnish the standard styles of railway materials made by his firm from a stock kept in this country. He also perfected a system whereby orders which call for special manufacture will be shipped promptly.

Persifor F. Smith, district manager of the American Sheet & Tin Plate Co., has resigned. Ill health and a desire to retire from active business are the causes of his action. Mr. Smith was formerly one of the heaviest stockholders in the Wellsville, O., plant purchased by the American Sheet Steel Co. Planished sheets are manufactured almost exclusively at this place.

F. Ernest Porter, superintendent of the North Sharon works of the Carnegie Steel Co., Sharon, Pa., has resigned. He has been in charge of this plant for eight years.

The plant of the Zanesville Iron Co., Zanesville, O., will be offered at public sale for the fourth time Saturday, Nov. 26. The property is appraised at $34,500. The creditors who objected to the sale to F. M. Baumgarten and others have guaranteed that a bid of not less than $23,000 will be made.

The Duncansville, Pa., plant of the Carnegie Steel Co. is idle and will not again be operated until the trouble which the company is having over the payment of taxes will be settled.

OBITUARY.

Wallace T. Foote died at his home in Port Henry, N. Y., Oct. 20. He was born in Middlebury, Vt., on March 18, 1825; established himself in Port Henry in 1847 and from that time to his retirement from business in 1885, he was identified with the iron business of northern New York and Boston. In 1855 he erected the first iron stack furnace in the United States. This he followed shortly after by the introduction of the closed hopper top and the use of hot blast.

Charles R. Blake, president of the Sligo Iron Store Co., St. Louis, Mo, died Oct 20 He lived in Alton, Ill, for many years and went to St. Louis in 1877. He was born in Cincinnati in 1845.

David W. Baldwin, aged 89, died Oct. 19 at Watertown, N. Y. He founded the steam engine industry in that city, and in war times manufactured guns for the government.

Cornelius Shields, general manager of the Lake Superior Corporation, Sault Ste. Marie, Ont., died Oct. 28, from heart failure. Mr. Shields had been ill with tonsilitis for two days, but his death was entirely unexpected. He began his railroad career in La Crosse, Wis., in the early 70's as telegraph operator for the old Southern Minnesota railroad, now a part of the Chicago, Milwaukee & St. Paul, and rose to the position of superintendent. He was at one time manager for the Dominion Iron & Steel Co. in New York. He was president of the Consolidated Lake Superior Co. just prior to the reorganization and after the reorganization was made general manager He was a man of great energy and force, always possessed of a clear head and sound business judgment. He was 49 years of age.

R. H. Gilmore, superintendent of the Brooks Locomotive Works, Dunkirk, N. Y., died at Schenectady, N. Y., Oct 26. Death was very sudden and was due to heart disease.

The C. W. Hunt Co. of West New Brighton, New York, was notably successful at the World's Fair, two of its three exhibits securing highest awards. The third was not entered. The Hunt industrial railway received the gold medal for narrow gauge railways, and the electric storage battery locomotive built by that company received the silver medal, being the highest award for this type of locomotive.

The Department of Commerce and Labor has introduced a new feature in connection with the monthly summary of commerce and finance. Commercial notes made up from foreign publications and relating to commerce, commercial conditions and commercial opportunities in various countries are being published for the benefit of those interested in foreign commerce.

The Commercial Club, of Springfield, O., which has raised $5,000 to purchase a site in that city for the new shops which the Detroit Southern railroad expects to build, is in receipt of a letter from President and Receiver Samuel S. Hunt, in which the offer is declined because the company wants ground and not money.

Iron ore receipts at Ashtabula for October were the heaviest on record. The total gross tons unloaded at that port during that month were 849,588. The figures for the corresponding month of the past four years are: 1900, 436,944 tons; 1901, 550,753 tons; 1902, 566,867 tons; 1903, 464,390 tons. The largest month's receipts during the previous four years were: 1900, 686,339 tons; 1901, 782,452 tons; 1902, 736,564 tons; 1903, 799,589 tons. Conneaut also shows large increase in ore receipts, those for October being 776,180 tons.

The Mary furnace of the Ohio Iron & Steel Co., Lowellville, O., was blown in this week. The stack is 18 x 25 ft. and has a daily capacity of about 350 tons of Bessemer or chilled basic pig iron.

THE IRON TRADE REVIEW

Devoted to the Machinery, Metal-Working and Foundry Trades and Iron and Steel Manufacture.

PUBLISHED EVERY THURSDAY BY

THE PENTON PUBLISHING CO.

CLEVELAND, OHIO.

CHICAGO - - - - - - - 1164 Monadnock Block.
PITTSBURG - - - - - - - 429 Park Building.
NEW YORK - - - - - - - - 150 Nassau St.

Subscription, $3.00 per annum. To Foreign Countries, $4.00. Advertising Rates Furnished on Application.

The Cleveland News Co. will supply the trade with THE IRON TRADE REVIEW through the regular channels of the American News Co.

ENTERED AT THE POST OFFICE AT CLEVELAND, O., AS SECOND CLASS MATTER.

NOVEMBER 3, 1904

DRY AIR BLAST IN IRON MAKING.

It is a source of gratification that the second American meeting of the Iron and Steel Institute should have been marked by the presentation of a paper that ranks among the most important in the annals of that organization. The data presented by Mr. James Gayley in recounting the operations at Isabella Furnace in the "Application of Dry Air Blast to the Manufacture of Iron" clearly belong in the category of the revolutionary and epoch-making in iron manufacture. There was no hesitation on the part of those who discussed the paper at New York in saying that it presented discoveries of first importance and made the iron trade of the world debtor.

An interesting feature of the comment on Mr. Gayley's paper was the abundance of testimony offered as to the general recognition of varying humidity in the atmosphere as a great bane of blast furnacemen. But knowledge of an evil and knowledge of an effectual cure for the evil are vastly different things—as different in the case in point as in the problem presented by phosphoric ores and pig iron before the basic lining for open-hearth furnaces was hit upon. Yet it does not appear that the moisture in the atmosphere, in spite of the common knowledge that it is a trouble-maker in blast furnaces, was credited with anything like its real capacity to produce irregular working, reduce output and run up fuel consumption. It took long-continued scientific study of atmospheric conditions to appreciate that the game was worth the candle; that the drawback of humid air, and particularly air of rapidly and greatly changing humidity, was of such proportions as to warrant a large investment to secure dry air.

Mr. Gayley has gone far enough to demonstrate that in blowing dry air into a blast furnace—most important of all, air of a constant content of moisture—there is a saving of 20 percent in coke consumption, and an increase of 25 percent in the output of the furnace. There have been other important economies. The greater uniformity in furnace working has cut down slips, and the waste of ore dust through escaping gases has been reduced from 5 percent of the ore charged to 1 percent. The saving in coke consumption reduces phosphorus in the pig iron and permits the use of higher phosphorus ores for the making of Bessemer pig—a development highly important in view of the known limitations on the reserves of lower-phosphorus ores in the Lake Superior region. The tendency among buyers of Bessemer ores in recent years has been to push down the phosphorus limits, and this has gone on until 0.045 became the standard for phosphorus, or considerably below the permissible limit in Bessemer practice. Mr. Gayley's invention will permit of relaxing the phosphorus requirements and thus widen the field of material from which pig iron will be produced for the converter.

While no definite figures were given at the New York meeting as to the saving possible by the use of the dry blast, the economies shown in the comparative statements in the paper itself suggest a marked reduction in pig iron cost—possibly in the neighborhood of $1 a ton, on the basis of recently prevailing values for raw materials, and scaling up as prosperity values are again reached. If continued experiments confirm all the conclusions thus far drawn from the operations at the Isabella plant, furnaces that do not blow dry air will be at as great disadvantage in competition with those equipped with refrigerating apparatus as the small furnaces with iron stoves have been in recent years in attempting to compete with the 500-ton stack equipped with modern stoves. As one of the participants in the discussion on the paper said, it means a larger investment for blast furnacemen, but it means also the cheapening of iron-making and is therefore distinctly in the line of progress. Cheaper iron and steel have been the result of every advance step in their manufacture, and on no other line can the cumulative consumption of steel in the world continue to exceed itself.

HEAVY RAIL EXPORTS TO CANADA.

The exports of steel rails from the United States in September show a heavy increase over August, being 62,375 tons against 35,631 tons in the preceding month. Of this total, 44,706 tons were to British North America and it is probable that the exports to Canada for October will be still larger. After that, a decided falling off may be expected, as the Canadian tariff of $7 per ton became effective Nov. 1. Other increases in the export movement were: Pig iron, 8,774 tons against 1,315 in August; scrap, 5,190 tons against 2,772 tons in August; wire, 8,045 tons against 5,796 tons. There was a falling off in some products. The exports of billets, ingots and blooms were 26,175 against 28,379 in August. Bar iron exports declined from 3,427 to 1,541 and wire rods from 5,309 to 287. For the nine months, the totals for steel rails and crude steel are: 11,611 of the former for 1903 and 272,696

for 1904, and 1,056 for 1903 and 262,626 for 1904 of crude steel. The detailed exports of which tonnage is reported are as follows:

EXPORTS OF IRON AND STEEL FROM THE UNITED STATES—GROSS TONS.

	September		9 mos. end'g Sept.	
	1903	1904	1903	1904
Pig iron	1,120	8,774	11,984	36,428
Scrap	202	5,190	3,130	22,.14
Bar iron	1,305	1,541	15,289	22,383
Wire rods	683	287	19,043	14,041
Steel bars	532	2,350	13,784	19,754
Billets, ingots and blooms	37	26,175	1,056	262,626
Hoop, band or scroll iron	126	32	1,433	2,151
Iron rails			143	1,387
Steel rails	6,487	62,375	11,611	272,696
Iron sheets and plates	1,693	276	4,357	3,383
Steel sheets and plates	518	6,750	9,082	30,408
Tin plates, terne plates and taggers' tin	1	723	169	5,382
Structural material	1,895	6,159	22,565	37,312
Wire	6,110	8,045	76,231	81,120
Cut nails	1,059	912	6,789	7,506
Wire nails	1,950	1,969	22,357	20,589
Other nails, including tacks	168	326	1,636	2,200
Total	23,886	131,884	220,659	841,580

The exports of ore were 55,408 tons against 27,324 in September, 1903. The value of exports, excluding ore, but including machinery and other items of which tonnage is not returned, was $11,150,815 in September against $7,293,250 in September, 1903. For the nine months, the values are: $92,565,937 in 1904 and $72,-714,360 in 1903.

Imports amount to less than one-sixth the tonnage of exports, the total for September on articles included in the table being only 20,973 tons, while a year ago in September the imports were 42,766 tons and in August, 1903, they were 86,452 tons. The total on articles named follows:

IMPORTS OF IRON AND STEEL TO THE UNITED STATES—GROSS TONS.

	September		9 mos. ending Sept.	
	1903	1904	1903	1904
Pig iron	16,414	8,684	547,386	60,627
Scrap	1,964	1,121	74,103	15,057
Bar iron	2,362	1,128	31,960	15,784
Iron and steel rails	2,196	2	87,273	34,231
Hoop, band or scroll	42	698	1,432	1,941
Steel ingots, slabs, billets or bars	13,530	647	243,210	8,848
Sheets and plates	1,057	159	7,895	3,614
Tin and terne plates	2,440	6,793	36,211	56,031
Wire rods	1,399	1,302	15,319	12,034
Wire and wire articles	470	179	3,748	3,009
Structural shapes	892	200	4,823	6,768
Total	42,766	20,973	1,053,360	217,944

The total value of imports of iron and steel, excluding ore, but including a number of lines in which tonnage is not ascertainable, was: $1,841,175 in September, 1904, and $2,362,709 in September, 1903. The values for the nine months were: $16,591,000 in 1904, $34,652,234 in 1903 and $27,838,237 in 1902. Iron ore imports were 8,684 tons in September, 1904, and 16,414 in September, 1903.

The Cumberland Steel Co. advises us that the recent mention in the official report of the Crucible Steel Co. of America, reprinted in these columns on Oct. 20, of a mortgage of the Cumberland Steel Co. for $32,500, was an error. It adds that the Crucible Steel Co. of America has no claim against the Cumberland Steel Co. and never had, though there is understood to be some claim against another concern in the Cumberland district, which may account for the error.

The next annual convention of the Southern Hardware Jobbers' Association will be held at Virginia Hot Springs, June 6, 7, 8 and 9, 1905. The headquarters will be at the New Homestead Hotel.

NEW BLAST FURNACE RECORDS AT DUQUESNE.

(Special Telegram.)

PITTSBURG, Nov. 2.—While at Duquesne yesterday the Iron and Steel Institute visitors were apprised of new world's pig iron production records. Furnace No. 1 of this group of four stacks produced 793 tons on Oct. 27, exceeding all previous records for this plant, and the output of the four stacks during the month breaks all records of any four blast furnaces during a similar period. The four stacks produced 74,608 tons of iron, while the best previous record was 74,192 tons in January, 1902. The furnaces making this latter record included two at the Carrie plant, one at Edgar Thomson and one at Youngstown. On Oct. 27 the four stacks in the Duquesne group produced 2,700 tons of iron and during the week of Oct. 22 to 29 furnace No. 1 had an output of 5,001 tons. During the entire month this stack produced 20,659 tons, while the weekly average of the four was 17,783 tons. The bulletin containing this information also said that one of these furnaces produced 1,287,381 tons of iron on one lining, while the four furnaces produced 4,469,855 tons without change of lining. Furnace No. 1 was blown in on June 8, 1896, and is 100 by 22 ft. The iron from these furnaces is used in the Duquesne Steel Works, direct metal being taken to the steel works mixers.

Leased by Pittsburg Coal Co.

(Special Telegram.)

PITTSBURG, Nov. 2.—The Pittsburg Coal Co. has leased the coal properties of the Pittsburg Terminal Railroad & Coal Co., owned by the Wabash system. The output of these mines is about 250,000 tons a month. The deal removes the most dangerous rival of the Pittsburg Coal Co. to the great lakes. The lease is to run for a term of five years.

National Founders' Association.

The annual meeting of the National Founders' Association, which will be held at Cincinnati on Nov. 16 and 17, promises to be well attended. The convention headquarters will be at the Grand Hotel and a number of reservations have already been made. The hotel management reports these reservations coming in daily. The Boston and St. Louis members have arranged for special cars. There will be a banquet on the evening of Nov. 16. The administrative council will meet on the 14th and 15th and will report to the convention when it meets on the 16th.

The Niagara Transit Co., represented by Harvey L. Brown and W. Mills, of Buffalo, has closed a contract with the American Shipbuilding Co. for a 10,000-ton freight steamer. The new boat, which will cost $410,000, will come out July 1, 1905. The big freighter will be 545 feet over all, 525 feet keel, 55 feet beam and 31 feet deep. She will have thirty-two cargo hatches with patent covers of steel plate, all operated by steam.

Eastern parties are figuring on buying a number of the small vessels of the Pittsburg Steamship Co.'s fleet and if the deals that are on go through the boats will probably go to the coast before the close of navigation. The company has twenty-two vessels with a carrying capacity of less than 3,000 tons, and the officials of the company are anxious to sell all the boats of that class.

The Duluth & Iron Range railroad will next winter rebuild ore dock No. 3 at Two Harbors and add to it seventy-eight pockets, making 168 in all, the same size as docks Nos. 4 and 5. In preparation for the expected heavy ore traffic the road has also ordered 300 new steel cars and four heavy locomotives.

The Labor Situation.

NEW YORK AGREEMENT CONSTRUED.

At the controversy between the union molders and foundrymen, of Utica, N. Y., the joint committee of employers and employes, to which was referred the dispute as to the New York agreement, adopted the following resolution: "Resolved, That it is the sense of this joint committee that the following is the proper interpretation of the New York agreement: 'If any change, whether of wage rate, shop practice or conditions or any other change affecting the relations or the interests of the members of the parties to the New York agreement, is proposed by one of the parties thereto to which objection or protest is raised by the other party, it is understood and agreed that the status then existing, that is the status immediately preceding the proposed change shall not be disturbed by either party pending reference and decision as provided in the New York agreement.'"

It is probable the matter will come up for further consideration at the convention of the National Founders' Association at Cincinnati.

AN AGREEMENT FOR ARBITRATION.

The recent agreement between the Sheet Metal Workers of Philadelphia and the employers is of unusual interest. The agreement is perpetual, while it requires the employers to employ only union men, it has a provision for prompt impartial action in case of disputes or complaints, without strikes or lockouts. When changes are desired, the party proposing them must give notice three months before the end of the year, and conference committees shall meet two weeks after notice is given, and if the committees fail to agree before Dec. 1, the matter shall be submitted to an arbitrator, whose decision shall be made not later than Dec. 15. If a dispute arises between an individual employer and his men, two members of the Employers' Association and two members of the union shall meet and select an abitrator, whose decision must be made within four working days. The promptness of the arbitration provisions made them acceptable to the union. The main objection which labor bodies had to arbitration hitherto was its slow progress.

EIGHT-HOUR CLAUSE ILLEGAL.

Judge L. W. Halsey, of the State Circuit Court at Milwaukee, has decided that the eight-hour day clause in the city contract is illegal. The decision was rendered in a suit brought by an officer of the Filer & Stowell Co. against the city of Milwaukee and the William Tod Co., Youngstown, O., to restrain them from carrying out a contract for a 20,000,000-gal. pump, which contained the objectionable eight-hour a day clause. The decision rules that the clause lessened and restricted the number of bids, thereby increasing the price by many thousands of dollars, and is in direct violation of the section of the city charter, which requires that all contracts shall be let to the lowest bidder. The case will probably be carried to the State Supreme Court.

THE MOLDERS' STRIKE AT CINCINNATI.

There has been continued progress in the matter of filling the Cincinnati shops by the National Founders' Association, and the foundries are now running in fairly good shape. The Newport Iron & Brass Works will start up Wednesday morning with a force of eleven men sent in by the N. F. A. An arrest has been made for contempt and the case will be tried on Wednesday. The contempt is the violation of the court's injunction against picketing.

METAL TRADES ASSOCIATION NOTES.

Reports from various parts of the country indicate that the various unions of metal working mechanics are busy strengthening their organizations and preparing for aggressive campaigns of extension. All indications point to extreme activity among these unions, so soon as better business conditions prevail. At present, there is little trouble anywhere in the country, although the machinists are keeping up the semblance of a fight in two or three places.

The boilermakers have called off certain of their strikes in New York city.

The sawmakers employed by the Curtis & Co. Mfg. Co., of St. Louis, went out on strike because a non-union man was employed. This company has now declared that it will maintain an open shop in that department as in all other departments of its business.

The Plan and Scope committee of the N. M. T. A. met in the Cincinnati offices on Tuesday and Wednesday of last week. The two days were spent in discussing the various matters referred to this committee by the Philadelphia convention and in formulating plans for facilitating the work of the organization, particularly with reference to securing the affiliation and close co-operation of local employers' associations throughout the country.

The administrative council of the N. M. T. A. was in session in the rooms of the Union Savings & Trust Co., this city, Thursday and Friday. A great amount of routine business was disposed of and various reports and recommendations acted upon. The members of the council were unanimous in the statement that the affairs of the association were never in better shape and that the loyalty of the membership has never before been so apparent.

The result of the mail ballot recently taken on the subject of change in initiation fee was presented to the council and such amendment was found to have been passed by an overwhelming majority of the votes of the members. This change makes the initiation fee $25 in lieu of a deposit in the reserve fund required by the by-laws. Under the old rule the deposit in the reserve fund of new members was based on the number of operatives and the amount in the reserve fund at the time the member was admitted.

Action was taken respecting the distribution of the reserve fund of the association and additional banks were selected as depositories. It is the policy of the association to distribute its funds in banks located in various industrial centers throughout the country and, as its reserve fund grows additional depositories are determined upon.

It was determined to change the name of the monthly magazine published by the association, which has heretofore been known as the *Bulletin*, to the *Open Shop*, it being felt that the latter name more correctly conveys the scope of the publication which has far outgrown the original purpose of a monthly bulletin of the affairs of the association. The *Open Shop* will treat all phases of economics relating to employer and employe. Its paid circulation is already quite large.

The council designated March 30 and 31, 1905, as the time and Chicago as the place for holding the next annual convention.

Secretary Wuest has gone to Chicago to close up the affairs of the association there in connection with the recent strike.

LABOR NOTES.

The union machinists have refused discontinuing the strike at Quincy, Ill., which has been in progress for the last 18 months. Since the strike was inaugurated the following firms have declared for the open shop: Quincy Engine Works, Central Iron Works, Wiebmer & Baecker, Modern Iron Works, Electric Wheel Co., E. Best Plumbing & Heating Co., Gardner Plumbing & Heating Co.

The Hamilton furnace at Hanging Rock, O., has blown in again this week after an idleness of six months.

Cincinnati Machinery Market.

CINCINNATI, Nov. 1.—While the demand for machinery and machine tools does not have any of the complexion of a boom, the improvement in the past two months is quite gratifying to local manufacturers. It would seem that buyers have become satisfied that the approaching election will have no untoward effects on the business situation and are placing their orders for new equipment with confidence. The Cincinnati machine tool makers have had a generous share of the large Japanese orders placed within the past two months and with an improved general demand there has been such a gratifying improvement in the machinery market as to give a cheerful tone to reports regarding the condition of this industry. The most noticeable improvement is in the demand for lathes. Some report the inquiries and sales improving for motor-driven machines while others note the demand mainly for the standard types. Foreign business on the whole is about of usual proportions, but where special efforts have been made to secure foreign trade there is enough business resulting to justify the effort.

The outlook for the winter and spring is regarded with confidence. With the election out of the way and with nothing having taken place to disturb the excellent outcome of the crops, there is a feeling that business affairs are again on the upward trend.

The National Machine Tool Builders' Association will hold a meeting on Nov. 15 and 16 at the Hoffman house in New York city. From the notice sent out by Secretary P. E. Montanus it is to be an interesting meeting and the list of subjects to be considered will no doubt attract a good attendance. The Cincinnati members will be represented as usual in goodly numbers and will probably arrange to go in a body in a special car.

The Rahn-Mayer-Carpenter Co. has enjoyed a marked increase in orders and in the near future will add to its shop equipment. The company has added to its line 18 and 20-in. lathes.

Greaves, Klusman & Co. report business improving, with a good line of inquiry in hand and the outlook promising. Their shop is running full time. They have recently booked a good Mexican order.

The Lodge & Shipley Machine Tool Co. has had two good months of satisfactory business. Orders received indicate the tendency on the part of buyers to select machines of the highest efficiency in spite of the increased cost. Motor-driven tools are gaining in favor.

The Cincinnati Machine Tool Co. notes an increase in orders, especially within the last two days. The company is now well established in its new building and is installing new heating apparatus at its plant.

The John Steptoe Shaper Co. is bringing out a new motor-driven shaper which will be on the market within a few weeks.

The Cincinnati Milling Machine Co. finds continued increase in orders, both foreign and domestic. October was the best month the company has had in the past eighteen months. Among the orders booked was one for 16 machines for the Bethlehem Steel Co., of South Bethlehem, Pa.

The Oesterlein Machine Co.'s new plant is well under way. Part of the construction up to the second floor is completed. The company hopes to occupy the new plant by Jan. 1.

The Cincinnati Chamber of Commerce placed the contract for an entire new electric lighting equipment. The contract for the engine was secured by the I. & E. Greenwald Co., and the generator contract was awarded to the Bullock Electric Co

The McIlvaine & Spiegel Boiler & Tank Co. has had a busy summer and fall, but as the winter approaches, with the lessening of construction work, business is seaonably quiet. The company has secured the order for the boilers for the new plant of the Oesterlein Machine Co.

The Bickford Drill & Tool Co. reports an improvement in orders, both foreign and domestic, and the outlook bright for the future.

The Cincinnati Planer Co. has no change to report in conditions, which means that the gratifying improvement noted for the past two months still continues.

The American Tool Works Co. has recently secured an order for four motor-driven lathes, to be shipped to Brazil. Business is improving with this concern and lathes are having the call, although business is fair in the other lines. Foreign inquiry is moderate. Orders are widely distributed and not confined to any particular interest or locality.

MACHINE TOOL BUILDERS' CONVENTION.

Secretary P. E. Montanus, of the National Machine Tool Builders' Association, has announced that the executive committee has fixed Nov. 15 and 16 as the dates of the next convention of the association, and the Hoffman house, New York, as headquarters. The convention is expected to discuss important questions affecting the machine tool trades, including the course of prices during the depression in business that has followed the last meeting. The membership of the association now consists of the following firms:

Hendey Machine Co., Torrington, Conn.
B. F. Barnes Co., Rockford, Ill.
Detrick & Harvey Machine Co., Baltimore, Md.
Baush Machine Tool Co., Springfield, Mass.
Blaisdell & Co., Worcester, Mass.
Draper Machine Tool Co., Worcester, Mass.
Prentice Bros. Co., Worcester, Mass.
Reed Co., F. E., Worcester, Mass.
Whitcomb Manufacturing Co., Worcester, Mass.
Woodward & Powell Planer Co., Worcester, Mass
Norton Emery Wheel Co., Worcester, Mass.
C. E. Sutton Co., Toledo, O.
Flather & Co., Inc., Nashua, N. H.
Flather Planer Co., Mark, Nashua, N. H.
Binsse Machine Co., Newark, N. J.
Gould & Eberhardt, Newark, N. J.
Davis Machine Co., W. P., Rochester, N. Y.
W. A. Wilson Machine Co., Rochester, N. Y.
American Tool Works Co., Cincinnati, O.
Bradford Machine Tool Co., Cincinnati, O.
Bickford Drill & Tool Co., Cincinnati, O.
Cincinnati Machine Tool Co., Cincinnati, O.
Cincinnati Milling Machine Co., Cincinnati, O.
Cincinnati Planer Co., Cincinnati, O.
Cincinnati Shaper Co., Cincinnati, O.
Dietz Machine Tool Co., Cincinnati, O.
Fosdick Machine Tool Co., Cincinnati, O.
Greaves, Klusman & Co., Cincinnati, O.
Hisey-Wolf Machine Co., Cincinnati, O.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
LeBlond Machine Tool Co., R. K., Cincinnati, O.
King Machine Tool Co., Cincinnati, O.
Queen City Machine Tool Co., Cincinnati, O.
Rahn, Mayer, Carpenter Co., Cincinnati, O.
Schumacher & Boye, Cincinnati, O.
Hamilton Machine Tool Co., Hamilton, O.
Fairbanks Machine Tool Co., Springfield, O.
Springfield Machine Tool Co., Springfield, O.
Owen Machine Tool Co., Springfield, O.
Jones & Lamson Machine Co., Springfield, Vt.
Ridgway Machine Tool Co., Ridgway, Pa.

President A. C. Pessano, of the Great Lakes Engineering Works, Detroit, closed a contract at Philadelphia last week with the Erie & Western Transit Co. (Anchor Line), for the construction of a package freight steamer to be a duplicate of the steamer Muncy. She will be 350 ft. long, 64 ft. beam and 30 ft. deep. The contract calls for delivery next October.

The Warner Iron Co., Nashville, Tenn., will blow in its Cumberland furnace about Jan. 1, 1905.

NEW BOOKS.

"Friction and Lubrication" has passed through one edition and now appears with an addition of 35 pages. The book contains the gist of a long experience with lubricants. The author, William M. Davis, is a practical engineer and for some ten years was in the employ of an oil refining company. His present occupation is that of oil inspector with the American Sheet & Tin Plate Co., and he is in charge of the lubrication of engines and machinery at the various plants of this company. The subject is lucidly handled and the work is well fitted to the every-day requirements of those in charge of machinery. The book contains 265 5½ x 8-in. cloth-bound pages. There are numerous illustrations and a good index. Price, $2. Published by the Lubrication Publishing Co., of Pittsburg.

"Steam Boilers," by H. de B. Parsons, treats of the theory and design of steam generators. The book contains substantially the lectures delivered by the author to the senior class of the Rensselaer Polytechnic Institute of Troy, N. Y. There are 375 6 x 9-in. pages in cloth binding. The author makes no claims to originality and asserts that it would be impossible to write a work on this subject which could be considered original. He further points the needful caution regarding the design that rests upon book knowledge only and advises the draftsman not to attempt the design of a steam boiler until he has had personal acquaintance with boiler shop practice. As he says: "There are many things in the actual putting together of the parts of a boiler which cannot be clearly described, and for just such things even a short shop experience would be most valuable." The author has nevertheless collected a wealth of data beyond the resource of any one shop. He may not describe some things which pertain to the practice of the craft, but these omissions refer rather to methods of manufacture and shop routine and are best acquired at first hand as he suggests. He is thoroughly independent in his treatment of topics and apparatus, as free and complete apparently as the limits of the book would allow. The excellent illustrations have in several instances to make up for the concise description that is offered. For example, four large and clear engravings on as many pages are briefly described in eleven lines. The four engravings show mechanical stokers, and, like the other views, are from good wax engravings. There are 28 tables. The chapters on fuels, combustion, chimney and artificial draft, incrustation, corrosion and smoke prevention will be found of especial merit and service to owners and managers of plants. The book is published by Longmans, Green & Co., of 91-93 Fifth avenue, New York. Price, $4.

"The Steam Turbine," by Robert M. Neilson, has been considerably enlarged and revised in the third edition now to hand. The chapters dealing with the Parsons and DeLaval steam turbines were increased and as a whole rewritten in the second edition. The chapter on marine propulsion was then extended to give a record of previous developments in this direction. Vanes and velocities came in for additional discussion. A new chapter was added for the description of the Westinghouse-Parsons, Stumpf, Schulz, Curtis and Seger turbines and another new chapter dealt with the important question of the amount of space saved by the adoption of high speeds. The appendix of the first edition was brought nearer to date and the patent record from Watt and Kempelen of 1784 is now presumably reliable to the close of 1901. The references are numerous and suggest much careful research and close scrutiny of the record of invention in steam turbine work. Mr. Neilson has a second appendix to the latest edition and this has tables of equivalent measures of heat and steam pressure and consumption. There are diagrams also illustrating the comparison of pounds per sq. in. and kilogrammes per square centimetre, different methods of expressing degrees of vacuum, etc. All the material has had general revision in the third edition and the book is a timely volume for easy reading. The author has assumed on the part of the reader no prior knowledge of the hydraulic turbine, though comparisons are made with the steam turbine and the hydraulic machine. There are 294 6 x 9-in. pages, profusely illustrated. Published by Longsmans, Green & Co., 91-93 Fifth avenue, New York. Price, cloth bound, $3.60.

A tractive power chart for determining the draw bar pull of locomotives is published by the Derry-Collard Co., of 256 Broadway, New York. The sheet is 15 x 20 in. and the figures and lettering of generous dimensions for ready reading. The curves plainly show power comparisons between locomotives—cylinders of different dimensions, various steam pressures, driving wheels of a wide range in diameter are easily combined and handled by the chart. The chart is of course equally useful for working backward from the draw bar pull to ascertain size of engine, etc. The lines on the chart have the added convenience of being alternately continuous and dotted—a point of considerable value for tracing purposes. The sheet is plainly printed, packed in tube and mailed postpaid for 50 cents.

Otis Steel Co.'s Report.

The eighth ordinary general meeting of the Otis Steel Co., Cleveland, was held recently in London. The chairman stated that the results of the year are satisfactory, taking into consideration the depressed state of trade which had existed in America. The gross profit on trading amounted to £20,838, which, added to the other sources of revenue, gave a total profit of £22,994. Deducting from that the London management expenses, and interest upon prior lien debenture stock, there remained a balance of £16,659. Writing off £12,500 for depreciation and applying the balance of £4,159 toward paying interest upon the A debenture stock, there was sufficient for the distribution of 2 percent, requiring £3,821, leaving a balance of £338 to the A debenture stockholders' expense account. The interest upon the A debenture stock being cumulative, the remaining 3 percent would be paid as soon as profits permitted. The sum set aside for debenture stock redemption account out of the profits of the last two years and the proceeds of the sale of a piece of the company's land in Cleveland amounted to £12,986. Debentures for £20,462 were redeemed out of that sum, so that a nominal profit of £7,475 was made by the company on the transaction. That, together with £6,386, applied to the same purpose out of last year's profit, and £4,428 carried forward last year, made a total of £14,283, which had been applied in writing down the property account. The amounts outstanding as assets under the heading of "Land for plant, machinery, use of tools, and goodwill," had been written down during the year from £636,970 to £601,068.

At the annual meeting of the stockholders of the Pittsburg Reduction Co., held at Pittsburg, an increase in the capital stock from $1,600,000 to $3,800,000 was authorized. All the directors were re-elected. It is left to the directors to decide as to the times and conditions of issuing the new stock.

The officers of the New Castle Forge & Bolt Co., New Castle, Pa., are considering the erection of a bar mill. The company is a large consumer of bar iron and steel and hopes to have a mill that will have sufficient capacity to supply all requirements of the finishing departments. The company is capitalized at $300,000.

The Monroe Business Men's Association, Monroe, Mich., was in Toledo, O., last week inspecting the plant of the Toledo Standard Steel Tube Co., which contemplates locating in Monroe. The visitors found the plant in good order and employing 60 men. The present capitalization is $60,000 and it will be increased to $150,000.

ACCIDENTS IN LAKE SUPERIOR MINES.

To the Editor:

Permit me to call your attention to a wrong impression conveyed by an article in your issue of Oct. 20 regarding the loss of life by fatal accidents in the mines in Iron county, Mich., and the probable carelessness on the part of superintendents in this county regarding the lives of employes. In comparing Marquette and Iron counties, the conditions existing in both should be taken into consideration. Iron River belongs in Iron county and not in Dickinson county, and is as far away from Crystal Falls as Amasa, where some of the accidents of the year occurred.

In order not to throw an unjust light on Iron county permit me to list the cause of the accidents and then you will be better able to judge where to fix the blame:

Fall of ground	3	
Fell down chute	1	
Blasted	4	
Suffocated	1	
Rock falling down shaft	1	
Fell down shaft	1	
Burned	1	
	—	12
Leg broken		2
		—
Total		14

From the fall of ground and suffocated accidents, the deceased came to their death by going against positive orders. The accidents of rolling through the chute and down the shaft certainly cannot be charged to the management, while of the four blasted three drilled into known missed holes and one used an iron tampering bar. The person burned to death threw a piece of lighted waste over a stope and fell in on top of it. His intention was evidently to see how much dirt they were getting down, but why, of course, we do not know. He was burned so badly he afterwards died. Of the fatal accident resulting from a rock falling down the shaft very little can be said, as its cause is not known. Both skips were down at the time and the landers away from the landing with the ore just hoisted. About this time a stranger was noticed around the shaft looking in and it is supposed he threw something down out of curiosity, which is the most plausible light we can get on the accident. This makes a total of twelve fatal accidents, and two accidents resulting in broken legs.

Our mine inspector reported men only from producing mines, and after counting in with the total the men employed at non-producing mines but whose shops and surface labor perform the work of the active mines that have no shops, the total will reach at least 200 more, or over 1,000 men employed in the county, an average of not over 12 fatal accidents to the 1,000.

Also, we would call attention to the labor situation. Mines in Marquette county have been producing ore for the past 50 years and owing to the different grades of ore produced have been found able to market their product, at least some of it, during the hard times. Thus intelligent English miners have established permanent homes at the Marquette county mining towns and the operators have an intelligent class of men to choose from, while in Iron county the grade of ore has always been non-Bessemer, and the mines the first to feel any depression. When mines in this county are started up after each little depression a class of labor comes here that cannot find employment elsewhere, and the great majority cannot speak or understand English, which makes it very hard to have instructions properly understood and carried out, while those who can understand English laugh at instructions regarding their safety and as soon as the boss has turned his back will immediately do just what they were told not to do.

Again, the character of the ore is such and the formation of ore bodies are so entirely different from those in Marquette county that the mining has to be done on different systems, but on systems that certainly would not endanger the life of a single man any more than other systems gotten up for safety and satisfactory operation.

From the above I think that you will come to the conclusion that the article referred to certainly was an unjust one to the mining superintendents and to mine operators. It is a very serious accusation that the superintendents in Iron county have not, probably, the same regard for the lives of their employes that is taken into account in Marquette county. I for one emphatically object to this accusation. I think the superintendents of this county are as humane as in any other, and I hope you will come to the same conclusion.

W. J. RICHARDS.

Crystal Falls, Mich.

New Railroad Equipment.

The Pennsylvania Railroad has placed an order for 6,200 cars, 6,000 of which are to replace damaged and worn out cars on the lines east and west of Pittsburg and which are not looked upon as an addition to the equipment. The orders for these cars have been about equally distributed among the American Car & Foundry Co., the Pressed Steel Car Co., the Standard Steel Car Co. and the Cambria Steel Co. The other 200 cars are additions to the equipment and will be built by the Cambria Steel Co. The Minneapolis, St. Paul & Sault Ste. Marie has ordered 1,000 box cars and 200 flat cars from the American Car & Foundry Co. The Hocking Valley Railroad Co. has ordered 200 box cars of the same company. The New York Central & Hudson River Co. has increased its order for coal and box cars from 1,500 to 2,000 each. The orders will be equally divided between the American Car & Foundry Co. and the Western Steel Car & Foundry Co.

The following companies have ordered locomotives from the American Locomotive Co.; the Chicago, Burlington & Quincy Railroad Co., 50 simple prairie type locomotives; the Chicago & Northwestern Railway Co., 16 locomotives; the Central Vermont Railroad Co., 9 passenger and 5 freight engines. The New York, New Haven & Hartford Railroad Co. is having 20 locomotives built.

The rebuilt stack of the Cherry Valley Iron Co., of Leetonia, O., which will soon be blown in, will be 18 x 80 ft., as compared with 17 x 75 ft., the size of the stack torn down. In addition, 100 coke ovens have been built, making a battery of 200 ovens at the furnace.

The Lackawanna Steel Co. has found that there is a plentiful supply of gas in its plant at Stonypoint, Buffalo, and will soon make a change in the construction department by the substitution of natural gas for coal and coke as fuel in its furnaces.

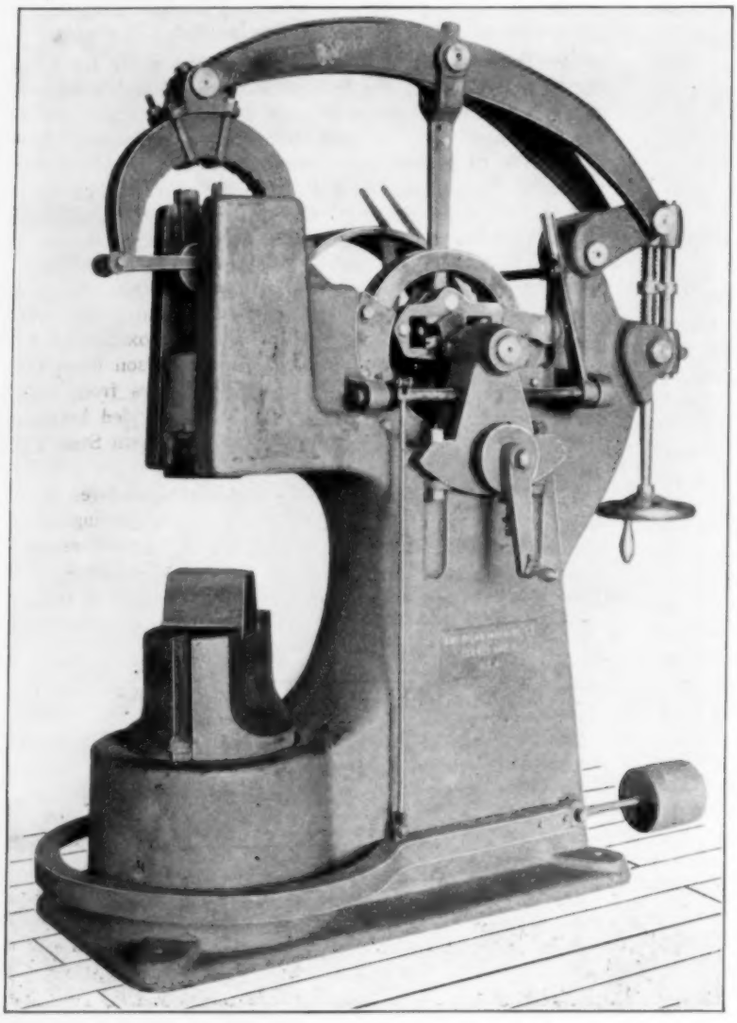
In order to settle satisfactorily the estate of the late Edward Huber, and to effect a reorganization that is intended to place the concern on a sounder basis and to settle all old indebtedness, John A. Huber has been appointed receiver of the Marion Malleable Iron Co., Marion, O.

The Davies Car Foundry Co., Waukegan, Ill., has leased a building and will put it in order to carry on a foundry business. J. R. Davies, president of the company, will be resident superintendent. Secretary H. Clinton Burnett and Treasurer James Murrie are both of Waukegan.

Eleven steam shovels to be used in the building of the Panama canal will be built by the Bucyrus Co., of South Milwaukee. This company received the contract upon its bid of $117,750.

THE "THOR" POWER HAMMER.

This hammer is composed of the usual frame, anvil, hammer head, a lever—to which the hammer head is attached by means of the spring—and a crank shaft acting on the lever. In the plane of the lever, there is supported in the frame a ring of comparatively large diameter through which the crank shaft passes. To the ring is jointed an arm connected to the crank of the shaft by a slot in which it reciprocates during the rotation of the crank, a journal or sliding block embracing the crank. The arm is oscillated by this movement and is connected to the lever by means of links. The length of the stroke is adjusted by revolving the ring. If the ring be rotated toward the right, the angle formed between the arm and the perpendicular through the shaft will be decreased. The stroke of the arm and consequently that of the lever and the hammer head, will thus be smaller. When the ring is rotated toward the left, the angle will increase and the stroke of the arm and hammer head will be greater. By means of the screw and hand wheel at the rear, the operating arm or lever is kept horizontal, when changed from small to large work, thereby keeping the full force of the blow in a horizontal plane.



THE AMERICAN MACHINE & MFG. CO.'S NEW HAMMER.

The advantage of this construction is that the hammer ascends slowly and descends quickly, as the crank at the rotation of the shaft acts on the outer part of the arm when the hammer head ascends, but on the inner part of the arm when the hammer head descends.

As will be seen by the description this construction will give a belt-driven spring power hammer, that during full running is variable for different strengths of the blow and is variable for different sizes of the forgings handled.

The hammer has an attachment for "stopping" the head at the top of the stroke in case of die and tool forging and stress is laid on the claim that during full running the hammer can be changed for different strength of blow without danger to the workman.

The capacity of one blow, type "Ca," is 801.8 ft. pounds. In consequence of this it will in many places make a good and cheap substitute for the steam hammer and has greater range than the common cushion and rubber hammers. It is made in two sizes.

The main dimensions and capacity of styles Ca and D are as follows: Weight of drop, 170 lb. and 95 lb. respectively; capacity of forging, 6-in. sq. and 4-in. sq.; drop, max., 9-in. and 5-in.; revolutions per minute, 175 and 225; horse power required, 4 and 1.5; total weight, 4,200 and 1,725 lb.

This hammer is built by the American Machine & Mfg. Co., of Cleveland.

Carpenter Steel Co. Reorganization.

Robert E. Jennings, receiver of the Carpenter Steel Co., of Reading, Pa., has filed his final report before Vice-Chancellor Stevens, and the court signed an order directing the receiver to turn over the property to the reorganization committee. The plan of reorganization contemplates the formation of a new corporation under the laws of New Jersey with an authorized capital of $1,200,000, and to issue $350,000 5 percent 10-year gold bonds, redeemable after two years, at option. Enough bonds are to be issued to the creditors to pay their claims. It is announced that Receiver Jennings will take an interest in the new company and accept the presidency.

The receiver's report shows the total value of new material, supplies and finished products on hand on Oct. 1 to have been $219,756, an increase of $66,382 over the value of the material on hand at the date of the inventory made on Dec. 8, 1903. Of the accounts and bills receivable shown in the schedule as of a face value of $60,071 and an estimated value of $47,508, the receiver has collected $41,277 and expects to collect about $1,000 more. Claims of creditors not preferred, numbering 112 and aggregating $282,633,121, have been presented and allowed for $266,592.76. The receiver says he endeavored, but without success, to complete the pending government contracts. Sales of merchant steel and wire from Nov. 6, 1903, to Oct. 1, 1904, aggregated $359,000. During the same period of the previous year sales were $721,200. The business conducted by the receiver has shown a profit of about $50,000. The total receipts of the receiver have been $639,578 and his disbursements $608,255.75. He had in cash on hand on Oct. 1 $31,323. There was then due him $49,031 and he then owed on accounts payable and the payroll $21,916. The excess of assets over liabilities and debts on Oct. 1, 1904, was $224,973.87. The receiver claims that the excess in assets over liabilities since his appointment has been increased $29,052.42.

At Reading, Pa., Oct. 28, Judge Ermentrout granted an order to Robert E. Jennings, receiver of the Carpenter Steel Co., to sell the plant in Reading to Wheaton B. Kuhnhardt and John C. Barron, of the reorganization committee, within 60 days, for $150,000.

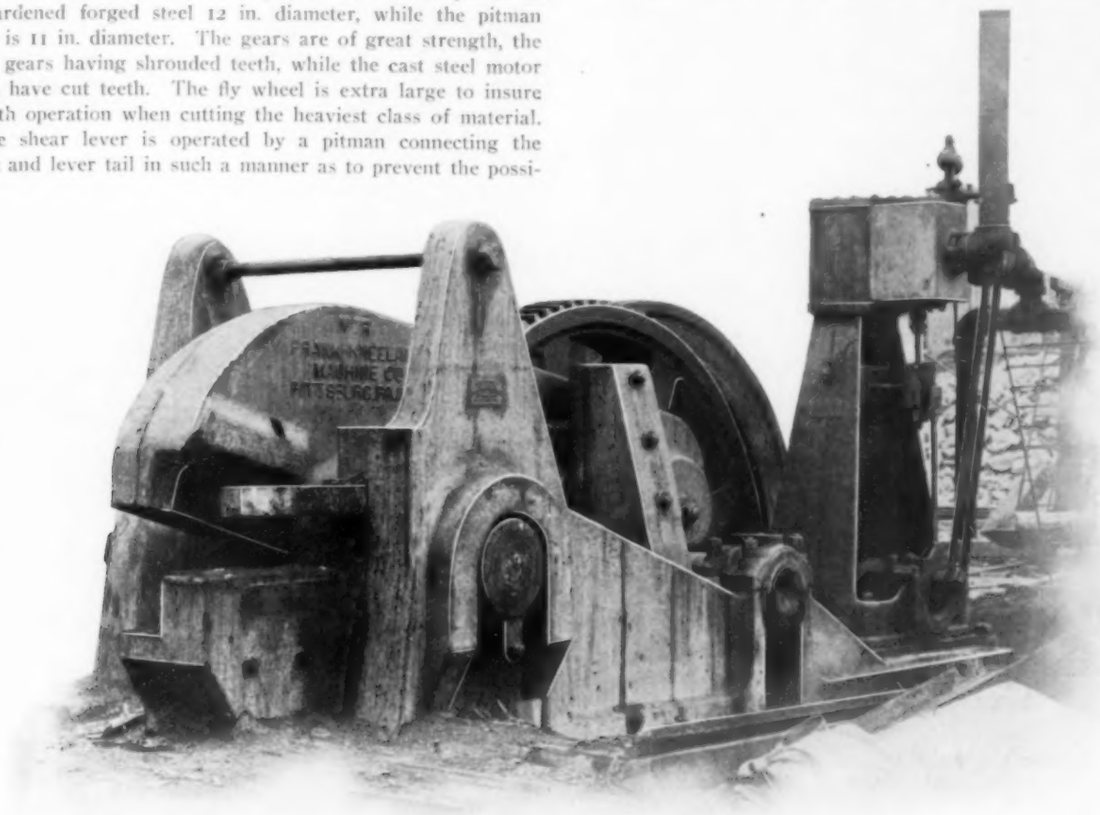
THE LARGEST LEVER SHEAR.

An illustration is given below of the most powerful lever shear ever built, having a rated capacity of 6½ x 6½-in cold steel with a record of cutting much heavier material. It was built by the United Engineering & Foundry Co., of Pittsburg, and is designated as the No. 7 lever shear.

This shear far exceeds any previous capacity and weight, the total weight being 180,000 pounds. The shear knives are 24 in. long by 8 in. wide and 2¾ in. thick, with four cutting edges. The driving power can be either by direct connected 15 x 16 in. specially designed heavy duty piston valve engine or a 125-h. p. electric motor. The shear is also furnished belt driven with a 20 x 60-in. pulley. The lever pin is of oil-hardened forged steel 12 in. diameter, while the pitman shaft is 11 in. diameter. The gears are of great strength, the main gears having shrouded teeth, while the cast steel motor gears have cut teeth. The fly wheel is extra large to insure smooth operation when cutting the heaviest class of material.

The shear lever is operated by a pitman connecting the crank and lever tail in such a manner as to prevent the possibility of the lever sticking and reduce friction and wear to a minimum. The pitman takes a babbitted knuckle bearing in the lever tail and a pin passes through the lever and pitman to insure the return stroke of the lever. The pitman is operated by a cast steel crank-shaft which carries the main driving gear on an enlarged hub, the diameter of which is more than twice the crank throw. This enlarged hub is inside the bearings and gives ample bearing for the wheel, with large leverage for the key, so there is no danger of fracture. The main pin is secured to the lever by a feather and oscillates on the bearings of the housings where any slight wear can be taken up by the adjusting wedges. The cutting edges of the knives are central with the bearings, thus making the load equal on each bearing and avoiding any tipping of the lever.

This shear is designed all the way through for heavy work and rough usage, all the parts being of massive construction, so that outside of the occasional redressing of the knives, it requires little if any attention.



THE LARGEST LEVER SHEAR.

Development and Use of High-Speed Steel.*

BY J. M. GLEDHILL.

A very important advance was made thirty or forty years ago, when "Mushet," or self-hardening steel, was introduced. This was the valuable invention of Robert Mushet, who, after a long series of experiments, made whilst he was manager of the Titanic Steel Co., succeeded in producing a Tungsten steel, and its introduction was a great advancement on the cutting powers of ordinary crucible steel, and for many years "Mushet" steel held a foremost place amongst tool steels.

It is now to America, however, that all honor must be given for the next great step in having "set the pace" and led the way in the present remarkable advancement in tool steel, and the author would here like to record that the greatest credit is due to Messrs. Taylor & White, who, at the Bethlehem steel works of America, initiated high-speed cutting, and at the exhibit of their firm in Paris some few years back, what were then considered to be astonishing results in speeds of cutting steel were publicly demonstrated. Since then still greater developments have been made by the author's firm in high-speed steels, and with increased experience in its manufacture, treatment, and application in our workshops, results in cutting powers far beyond expectation have been attained.

In those branches of the engineering world necessitating the use of tool steels in course of manufacture of their products, there is probably no section of greater importance thereto

*Prepared for the American meeting of the Iron and Steel Institute. The subject was also discussed by Mr. Gledhill in *The Iron Trade Review* of April 21, 1904, and repetitions in the present paper have been omitted in reprinting.

than that of the application and practical use of what is now known as "high-speed steel," and it may be said without doubt that no development in the annals of metallurgy has been more striking than the production of such steel, whilst the alacrity with which users have up to now appreciated and adopted high-speed cutting steel may be said to be almost comparable with the rapid powers of the steel itself! Perhaps this is not surprising when we look back and reflect that for many years past, previous to the advent of high-speed steel, practically but little advance had been made in the cutting powers of tool steels, feeds and speeds remaining more or less in a normal condition, and it must undoubtedly have often appeared to users generally that the cutting powers of the ordinary tool steels were very slow, and that the turn out of work could be greatly enhanced and economized if the cutting powers of tool steels could be substantially improved by some research of the metallurgist. Time has eventually realized those hopes to a large extent, and hence the desire now on all sides to use high-speed steel wherever possible. When it is seen that, with high-speed tools, steel can now be turned and machined at a rate up to 500 ft. per minute, and cast iron drilled at 25 in. per minute, it must be admitted that this is an astonishing advancement on the cutting speeds of 30 to 50 ft. per minute with ordinary crucible steel.

The production of steel capable of such cutting powers has not been obtained without exhaustive scientific research and trial, and the author may state that experiments have been made by him extending over a period of four years, during

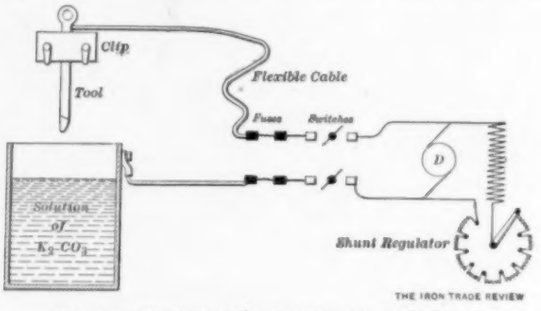


FIG. 1.—HEATING TOOL POINTS BY ELECTRICITY.

which time some eighty different compositions of high-speed steels were produced, and hundreds of trials made with them by actual cutting, and whilst some excellent results were obtained with many of them, others gave but indifferent ones. In the manufacture and production of high-speed steels (the best being made by the crucible process) the author has proved conclusively that the most satisfactory results are obtained only by using the purest qualities of Swedish or Dannemora irons, which on account of their freedom from impurities render them most suitable for producing tool steels that will best retain their cutting edges, and also the use of the highest qualities of the various alloys and other ingredients employed in the composition of the steel. Special care is required in the melting and subsequent treatment of ingots alloyed with high percentages of other metals so as to ensure homogeneity and regularity of quality, which is one of the most important points to be considered, for no permanent advantage or economy can be relied on if good results are obtained from one bar of steel and inferior results from the next, as will be the case where attention and experience are not exercised.

Influence of Various Elements.

A number of tool steels were made with the carbon percentage varying from 0.4 percent to 2.2 percent, and the method of hardening was to heat the steel to the highest possible temperature without destroying the cutting edge, and then rapidly cooling in a strong air blast. By this simple method of hardening it was found that the greatest cutting efficiency is obtained where the carbon ranges from 0.4 percent to 0.9 percent, and such steels are comparatively tough. Higher percentages are not desirable because great difficulty is experienced in forging the steels, and the tools are inferior. With increasing carbon contents the steel is also very brittle, and has a tendency to break with unequal and intermittent cutting.

Having thus found the best carbon content to range from 0.4 percent to 0.9 percent, the next experiments were made to ascertain the influence of chromium varying from 1.0 percent to 6.0 percent. Steels containing a low percentage are very tough, and perform excellent work on the softer varieties of steel and cast iron, but when tried on harder materials the results obtained were not so efficient. With an increased content of chromium the nature of the steel becomes much harder, and greater cutting efficiency is obtained on hard materials. It was observed with an increase of chromium there must be a decrease in carbon to obtain the best results for such percentage of chromium.

Mention may here be made of an interesting experiment to ascertain what effect would be produced in a rapid steel by substituting vanadium for chromium. The amount of vanadium present was 2.0 percent. The steel readily forged, worked very tough, and was hardened by heating to a white

THE SHADED PORTION SHOWS THE AREA OF ELECTRICAL CONTACT. THE NEGATIVE ELECTRODE SHOULD BE KEPT MOVING OVER THIS SURFACE WITHOUT APPROACHING TOO NEAR THE CUTTING EDGE OF THE TOOL.

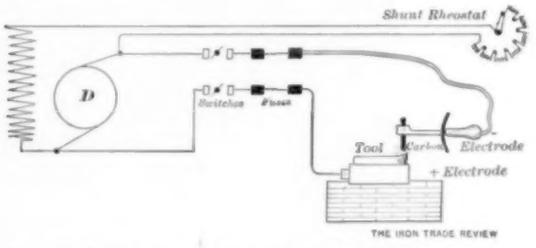


FIG. 2.—APPARATUS FOR HARDENING HIGH SPEED TOOLS BY MEANS OF AN ELECTRIC ARC.

heat and cooling in an air blast. This tool when tried on medium steel stood well, but not better than the steel with the much cheaper element of chromium in it.

Tungsten is contained in by far the greater number of the present high-speed steels in use. A number of experiments were made with the tungsten content ranging from 9.0 percent to 27.0 percent. From 9.0 percent to 16.0 percent the nature of the steel becomes very brittle, but at the same time the cutting efficiency is greatly increased, and about 16.0 percent appeared to be the limit, as no better results were obtained by increasing the tungsten beyond this figure. Between 18.0 percent and 27.0 percent it was found that the nature of the steel altered somewhat, and, instead of being brittle, it became softer and tougher, and whilst such tools have the property of cutting very cleanly, they do not stand up so well.

Molybdenum at the present time is under investigation, and our experiments with it have so far produced excellent results, and it is found that where a large percentage of tungsten is necessary to make a good rapid steel, a considerably less percentage of molybdenum will suffice. A peculiarity of these molybdenum steels is that in order to obtain the greatest efficiency they do not require such a high tem-

perature in hardening as do the tungsten steels, and if the temperature is increased above 1,000 degrees C. the tools are inferior, and the life shortened. It was found that the presence of from 0.5 percent to 3.0 percent molybdenum in a high tungsten steel slightly increased the cutting efficiency, but the advantage gained is altogether out of proportion to the cost of the added molybdenum.

A number of rapid steels were made with silicon content varying from a trace up to 4.0 percent. Silicon sensibly hardens such steels, and the cutting efficiency on hard materials is increased by additions up to 3.0 percent. By increasing the silicon above 3.0 percent, however, the cutting efficiency begins to decline. Various experiments were made with other metals as alloys, but the results obtained were not sufficiently good by comparison with the above to call for comment.

What Determines High-Speed Steel.

An analysis of one of the best qualities of rapid steels produced by the author's firm is as follows: Carbon, 0.55 percent; chromium, 3.5 percent; tungsten, 13.5 percent.

What may be said to determine a high-speed steel, as compared to an ordinary tool steel, is its capability of withstanding the higher temperatures produced by the greatly increased friction between the tool and the work due to the rapid cutting. An ordinary carbon steel containing, say, 1.20 percent carbon when heated slightly above the critical point and rapidly cooled by quenching in water becomes intensely hard. Such a steel gradually loses this intense hardness as the temperature of friction reaches, say, 500 degrees F. The lower

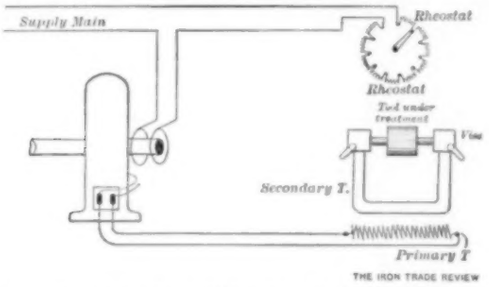


FIG. 3.—APPARATUS FOR TEMPERING MILLING CUTTERS, ETC., ELECTRICALLY.

the temperature is maintained the longer will be the life of the tool, so that the cutting speed is very limited. With rapid cutting steels the temperature of friction may be greatly extended, even up to 1,100 degrees F. to 1,200 degrees F., and it has been proved by experience that the higher the temperature for hardening is raised above the critical point and then rapidly cooled, the higher will be the temperature of friction that the tool can withstand before sensibly losing its hardness. The high degree of heating (almost to melting point, in fact), which is necessary for hardening high-speed steel forms an interesting study in thermal treatment and is indeed a curious paradox, quite inverting all theory and practice previously existing. In the case of hardening ordinary carbon steels very rapid cooling is absolutely necessary, but with high-speed steels the rate of cooling may take a considerably longer period, the intensity of hardness being increased with the quicker rate of cooling.

M. Le Chatelier states that: "Steel undergoes at 700 degrees C. a change of nature which has been studied in all its details by M. Osmond. This transformation, like a great number of chemical transformations, takes place with more or less considerable delay according to certain other circumstances. When heating, the transformation will take place above 700 degrees C.—for example, from 750 to 800 degrees C., according to the rapidity of heating. When cooling, below 700 degrees C. the quickness with which this transformation takes place at a given temperature, is governed by a general law of chemical phenomena, and this rapidity is so much the greater (1) As the absolute temperature in question is highest; (2) As it is at its greatest distance from the point of transformation." The transformation at the critical point takes only a very short time in the case of simple carbon steels, and the influence of such elements as chromium, tungsten, molybdenum, vanadium and manganese is to considerably retard this change.

Method of Preparing Tools.

The annealing of high-speed steel is best carried out in muffle furnaces designed for heating by radiation only, a temperature of 1,400 degrees F. being maintained from twelve to eighteen hours according to the section of the bars of steel dealt with. The steel may be raised to a yellow heat for forging, say 1,850 degrees F., at which temperature it is soft and easily worked into any desired form, the forging proceeding until the temperature lowers to a good red heat, say 1,500 degrees F., when work on it should cease and the steel be reheated. It is not advisable to break pieces from the bar whilst cold, the effect of so doing tending to induce fine end cracks to develop which ultimately may extend and give trouble, but the pieces should be cut off whilst the bar is hot, then be reheated as before and forged to the shape required, after which the tool should be laid in a dry place until cold.

A method may be described for preparing the tools. Forge the tools as before, and when quite cold grind to shape on a dry stone or dry emery wheel, an operation which may be done with the tool fixed in a rest and fed against the stone or emery wheel by a screw, no harm resulting from any heat developed at this stage. The tool then requires heating to a white heat, but just short of melting, and afterwards com-

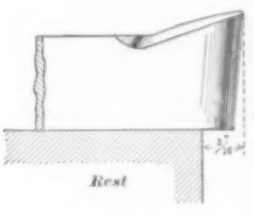


FIG. 4.

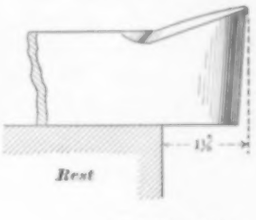


FIG. 5.

pletely cooling in the air blast. This method of first roughly grinding to shape also lends itself to cooling the tools in oil, which is specially efficient where the retention of a sharp edge is a desideratum, as in finishing tools, capstan and automatic lathe tools, brass workers' tools, etc. In hardening where oil cooling is used the tools should be first raised to a white heat, but without melting, and then cooled down either by air blast or in the open to a bright red heat, say 1,700 degrees F., when they should be instantly plunged into a bath of rape or whale oil, or a mixture of both.

Referring to the question of grinding tools, nothing has yet been found so good for high-speed steels as the wet sandstone, and the tools ground thereon by hand pressure, but where it is desired to use emery wheels it is better to roughly grind the tools to shape on a dry emery wheel or dry stone before hardening. By so doing the tools require but little grinding after hardening, and only slight frictional heating occurs, but not sufficient to draw the temper in any way, and thus their cutting efficiency is not impaired. When the tools are ground on a wet emery wheel and undue pressure is applied, the heat generated by the great friction between the tool and the emery wheel causes the steel to become hot, and water playing on the steel whilst in this heated condition tends to produce cracking.

Hardening and Tempering.

With regard to the hardening and tempering of specially formed tools of high-speed steel, such as milling and gear

cutters, twist drills, taps, screwing dies, reamers, and other tools that do not permit of being ground to shape after hardening, and where any melting or fusing of the cutting edges must be prevented, the method of hardening is as follows:

A specially arranged muffle furnace heated either by gas or oil is employed, and consists of two chambers lined with fireclay, the gas and air entering through a series of burners at the back of the furnace, and so under control that a temperature up to 2,200 degrees F. may be steadily maintained in the lower chamber, whilst the upper chamber is kept at a much lower temperature.

Before placing the cutters in the furnace it is advisable to fill up the hole and keyways with common fireclay to protect them.

The mode of procedure is now as follows:

The cutters are first placed upon the top of the furnace until they are warmed through, after which they are placed in the upper chamber and there thoroughly and uniformly heated to a temperature of about 1,500 degrees F., or, say, a medium red heat, when they are transferred into the lower chamber and allowed to remain therein until the cutter attains the same heat as the furnace itself, viz., about 2,200 degrees F. and the cutting edges become a bright yellow heat, having an appearance of a glazed or greasy surface. The cutter should then be withdrawn whilst the edges are sharp and uninjured, and revolved before an air blast until the red heat has passed away, and then whilst the cutter is still warm—that is, just permitting of its being handled—it should be plunged into a bath of tallow at about 200 degrees F. and the temperature of the tallow bath then raised to about 520 degrees F., on the attainment of which the cutter should be immediately withdrawn and plunged into cold oil.

Of course there are various other ways of tempering, a good method being by means of a specially arranged gas-and-air stove into which the articles to be tempered are placed, and the stove then heated up to a temperature of from 500 degrees F. to 600 degrees F., when the gas is shut off and the furnace with its contents allowed to slowly cool down.

Another method of heating tools is by electrical means, and by which very regular and rapid heating is obtained, and where electric current is available, the system of electric heating is quick, reliable and economical, and a brief description of this kind of heating may be of interest.

One method adopted of electrically heating the points of tools and the arrangement of apparatus is shown in Fig. 1. It consists of a cast-iron tank, of suitable dimensions, containing a strong solution of potassium carbonate together with a dynamo, the positive cable from which is connected to the metal clip holding the tool to be heated, whilst the negative cable is connected direct on the tank. The tool to be hardened is held in a suitable clip to insure good contact. Proceeding to harden the tool the action is as follows:

The current is first switched on, and then the tool is gently lowered into the solution to such a depth as is required to harden it. The act of dipping the tool into the alkaline solution completes the electric circuit and at once sets up intense heat on the immersed part. When it is seen that the tool is sufficiently heated the current is instantly switched off, and the solution then serves to rapidly chill and harden the point of the tool, so that no air blast is necessary.

Another method of heating the point of tools is by means of the electric arc, the heating effect of which is also very rapid in its action. The general arrangement and form of the apparatus here employed being as illustrated in Fig. 2.

The tool under treatment and the positive electrode are placed in a bed of non-conducting and non-combustible material and the arc started gradually at a low voltage and steadily increased as required, by controlling the shunt rheostat, care being taken not to obtain too great a heat and so fuse the end of the tool. The source of power in this case is a motor generator consisting of a continuous-current shunt-wound motor at 220 volts, coupled to a continuous-current shunt-wound dynamo at from 50 to 150 volts. Arcs from 10 to 1,000 amperes are then easily produced and simply and safely controlled by means of the shunt rheostat.

Electricity is also a very efficient and accurate means of tempering such forms of tools as milling, gear, hobbing and other similar cutters, also large hollow taps, hollow reamers, and all other hollow tools made of high-speed steel, where it is required to have the outside or cutting portion hard, and the interior soft and tenacious, so as to be in the best condition to resist the great stresses put upon the tool by the resistance of the metal being cut, and which stresses tend to cause disruption of the cutter if the hardening extends too deep. By means of the apparatus illustrated in Fig. 3 this tempering or softening of the interior can be perfectly and quickly effected, thus bringing the cutter into the best possible condition to perform rapid and heavy work.

Tempering of hollow cutters, etc., is sometimes carried out by the insertion of a heated rod within the cutter and so drawing the temper, but this is not entirely satisfactory, or scientific, and is liable to induce cracking by too sudden heat application, and further because of the difficulty of maintaining the necessary heat and temperature required, and afterwards gradually lowering the heat until the proper degree of temper has been obtained. In electrical tempering these difficulties are overcome, as the rod is placed inside the cutter quite cold, and the electric current gradually and steadily heats up the rod until the correct temperature is reached, when it can be held at such temperature as long as is necessary, and the current can be gradually reduced until the articles operated on are cold again, and consequently the risk of cracking by too sudden expansion and contraction is reduced very greatly. The apparatus used is very simple, as will be seen by reference to the sketch. It consists of a continuous-current shunt-wound motor directly coupled to a single-phase alternating-current dynamo of the revolving field type, giving 100 amperes at 350 volts, 50 cycles per second, the exciting current being taken from the works supply main.

The power from the alternator is by means of a stepdown transformer, reduced to current at a pressure of 2 volts, the secondary coil of the transformer consisting of a single turn of copper of heavy cross section, the extremities of which are attached to heavy copper bars carrying the connecting vises holding the mandrel upon which the cutter to be tempered is placed. The secondary induced current, therefore, passes through a single turn coil, through the copper bars and vises and mandrel.

Although the resistance of the complete circuit is very low, still, owing to the comparatively high specific resistance of the iron mandrel, the thermal effect of the current is used up in heating the mandrel which gradually attains the required temperature, slowly imparting its heat to the tool under treatment until the shade of the oxide on the tool satisfies the operator.

The method adopted to regulate the heat of the mandrel is by varying the excitation current of the alternator by means of the rheostat. An extremely fine variation and perfect heat control is easily possible by this arrangement.

Some Results with High-Speed Steel.

It has been proved that high-speed cutting is economical from a mechanical standpoint and that a given horsepower will remove a greater quantity of metal at a high speed than at a low speed, for although more power is naturally required to take off metal at a high than at a low speed (by reason of the increased work done) the increase of that power is by no means in proportion to the large extra amount of work done by the high-speed cutting, for the frictional and other losses do not increase in anything like the same ratio as a high-cutting speed is to a low-cutting speed. A brief example of this

may be given in which the power absorbed in the lathe was accurately measured electrically. Cutting hard steel, with 3-16-in. depth of cut, 1-16-in. feed and speed of cutting 17 ft. per minute, a power of 5.16 h. p. was absorbed, and increasing the cutting speed to 42 ft. per minute, the depth of cut and feed being the same, there was a saving in power of 19 per-cent for the work being done.

Another experiment with depth of cut ⅜ in. and traverse 1-16 in. compared with 1-16-in. traverse and 3-16-in. depth of cut, showed a saving in power of as much as 28 percent, and still proceeding with a view of increasing the weight of metal removed in a given time the feed was doubled (other conditions being the same) and a still further saving of power resulted. In a word, as in the majority of things, so it is with rapid cutting, the more quickly work can be produced the cheaper the cost of production will be.

A striking example of high speed planing on a large cast-iron turbine body was: Cutting speed 36 ft. per minute, depth of cut 1.25 in., and feed seven cuts per inch, the tool cutting for ten hours without necessitating grinding. Two tools were cutting, each taking a cut as described, the size of the planer being 14 ft. by 14 ft. by 30 ft.

An example of the great pressure-resisting powers of high-speed steel may be given. When cutting forged steel of about 30 tons per sq. in. tensile strength and offering a resistance to cutting of about 100 tons per sq. in., a tool of 1¼ sq. in. section was used, taking a cut of ⅞ in. in depth by ¼ in. feed per revolution, equivalent to an area of metal under cut of 0.21875 sq. in., the cutting speed being 90 ft. per minute, and removing 68¾ lb. of metal per minute, or the huge weight of 4,010 lb. per hour. The tool in this instance was projecting a distance of 1⅛ in. beyond the rest (see Fig. 5), and a calculation shows the stress on the tool to be as high as 78.5 tons per square inch. In another case, cutting forged steel of 35 tons tensile strength and offering a resistance to cutting of 115 tons per square inch, a 1¼-in. square tool being used, the diameter of forging was reduced by 1 in., equal to ½-in. depth of cut, whilst the tool advanced ⅜ in. every revolution, the cutting speed being 25 ft. per minute and removing 14½ lbs. of metal per minute. With the point of the tool projecting ¾ in. beyond the rest, the tool successfully withstood a stress of 51.6 tons per square inch.

A most important point to observe when taking heavy cuts is that of having the tools quite flat on the bottom side and supported as near as possible up to the extreme edge, as by so doing the pressures tending to break the tool are very considerably reduced. For example, the position of the tool as placed in the rest shown in Fig. 5, would cause a stress of something like 78.5 tons per sq. in. to be thrown on it, whereas when the overhang is reduced to one-half of the original distance, equal to 9-16 in., the stress is lowered to 14.27 tons per sq. in., a reduction of 80 percent.

Perhaps one of the most unlooked-for developments in the use of high-speed steel has been the manufacture from it of twist drills, and it would be safe to say that in no other sphere has the new steel justified itself to a greater extent than in the operations of drilling and boring, as its powers in that respect have revolutionized completely modern workshop practice. It is now possible in many cases to drill holes through stacks of thin steel plates, as quickly and economically as by pounching them, thus avoiding the consequent liability to distress the material due to punching action. The plates of torpedo and other boats, which are comparatively thin and of high tensile strength, can now be drilled in stacks with such facility that it is no longer necessary to punch the holes, whilst in many articles where it was formerly the practice to core in the holes, as, for example, in cylinder and other covers, or pipe flanges, etc., it is now cheaper and quicker to use high-speed steel and drill the holes out of the solid.

A short time back the author received a letter from a large firm of structural engineers in Glasgow giving some remarkable drilling results with high-speed drills, and the following extract may be quoted: "Drilling mild steel 2½ in. thickness made up of five ⅜-in. plates and one ⅝-in. angle iron, a 15-16-in. diameter twist drill made of high-speed steel, and running at 275 revolutions per minute, with a feed of 75 cuts per inch of penetration, drilled 7,924 holes without requiring regrinding, each hole being drilled in 42 seconds."

As a comparson of the superiority of high speed over ordinary drills, an instructive result was obtained when drilling forged steel gun-cradles of 5 in. thickness, and which steel is of a very tough nature. An ordinary twist drill was first tried and failed after drilling 8 holes, the end being completely fused, but a high-speed drill afterwards drilled 124 holes without suffering any injury whatever. The drills were 2 in. diameter, running at 80 revolutions per minute, and each hole was drilled in six minutes, this being the full power of the machine.

Equally satisfactory results are obtained from flat drills and other forms of boring tools made of high-speed steel for use in boring large holes out of solid bars, shafts, forgings, etc., the author's firm daily using drills of this type up to 12 in. diameter and boring holes up to 50 ft. long.

A considerable amount of doubt has been thrown from time to time on the inability to take finishing cuts with high-speed steel, and in the early stages of its development this contention was to a large extent justified, but experience and practice has brought the steel into line and rendered it possible to obtain an excellent finish at high speeds with tools suitably formed and properly arranged in the machines. Some very good examples of finished bright work at high speeds are exhibited and have been mostly made in semi-automatic machines, high-speed steel being used and one cut only taken, and it will be seen on examination that the surface finish is most excellent. These samples illustrate the finishing powers of high-speed steel when used in machines suitably adapted and they have been turned from the rolled bar with one cut only, being guaranteed accurate in diameter to 0.002 of an inch, whilst the excellence of surface finish will compare with the best obtainable by the old system of cutting, finishing and polishing.

It is impossible that the design of machine tools can remain on the old lines, since the difference between them and the cutting powers of the steel is so abnormal, and a sphere of immense area for the redesigning of machine tools is opened out to the ingenuity of the world's engineers. In the machine tool department of the author's firm, this branch of the subject of remodeling their tools has received the closest attention, and a type of their modern 18-in. center lathe for high-speed cutting may be mentioned. It is capable of exerting 65 horsepower equivalent to a belt width of 12 in., and with the aid of a variable speed motor a range of cutting speeds from 16 to 400 ft. per minute is possible, this comparing with an old type 18-in. lathe having a belt of 4-in. width and capable of exerting only about 12 horsepower.

In a similar way the old types of planing, milling, drilling machines, etc., are all more or less obsolete, and new designs are already constructed to cope with work at speeds and feeds described in this paper.

It is indeed a pleasure to see the new type of machine tool operating with high-speed steel, and treating the work it has to turn out in such a business-like way, throwing off shavings from steel and iron as one usually sees in turning wood, and imparting a life and energy to the whose establishment in remarkable contrast to the sleepy rate at which metals used to be turned and machined for so many years past, thus exerting an influence on everybody therein to get "a hustle" on that is positively exhilarating in its effects.

The powers of the cutting steel and the machine should be as nearly reciprocal as possible, for, given those conditions,

manufacturers place themselves in the most favorable position for the rapid and economical turn out of their products, and for best meeting their rivals in the open field of competition; and lastly, notwithstanding the wonderful results obtained with the new cutting steel, and developed comparatively so rapidly, nothing approaching finality must be admitted by the steel maker, but incessant diligence, experiment and research to discover still more the best combinations of nature's metals, should be his constant aim, and in the doing of which not only is there much pleasure derivable to himself, but in addition there is the benefit it is possible to render to the whole world.

DISCUSSION.

Prof. H. M. Howe: I wonder if Swedish steel has been shown to be any better than other steel not Swedish; whether steel by the cementation process is really essential. Most of us are looking with particular interest to developments from elements existing in the steel in larger quantities rather than to vanadium, tungsten, and other rarer elements. We know more perhaps about the results from chromium, silicon, and manganese. If the use of high-speed steels is to become common and is to last through generations we shall have to rely on the more common elements and not on the rarer elements in alloys.

T. Westgarth: I agree fully with what has been said as to the great advantage of using high-speed steel. Unfortunately the writer of this paper, perhaps unwittingly, has given only one-half of the subject. He has given too much credit, I think, to the steel itself. The fact is that we have to fit new head-stocks to our lathes and have had to condemn many of our machines because high-speed tools could not be used on them. You cannot get the advantage of high-speed steel without replacing your machines with much superior ones. In looking at these records of great saving in time we must remember that half the credit is due to the new and stronger machines. There are other advantages with these steels apart from the great saving in the time of performing certain operations. In a new smith shop we installed lately we found we cound do with one considerably smaller than the old one, for instead of forging our bolts and other supplies for our machine shop we can now cut them out of the solid with high-speed steel. Some of the figures cited, showing record time for performing certain operations are apt to be misleading. One that is given in the paper showed a record of 45 minutes as against 3 hours and 45 minutes previously. That must have been with special machines and not by using the same machine and fitting ordinary tools in one case and high-speed tools in the other. We have made an interesting discovery in our work and that is that by plating over our castings with chalk we make quite a saving in the time required to machine them when using high-speed steel. The reason for this we have not found out. Another advantage is that we have had no difficulty in getting the time bonus rates in our shops reduced fifty percent when employing high-speed steels.

H. H. Campbell: Concerning the statement in the paper that Swedish iron is necessary to the best quality of high-speed steel, I think careful consideration should be given before that is put on the record. We should not accept the traditions of the past as conclusive if there is some way of effectively testing the matter. Our company thinks we have made high-speed steels as good as a half-dozen other makes and we do not use any Swedish stock. If there is proof that Dannemora iron is needed it would be interesting to have it. It is true that the new machines are entitled to a part of the credit, but it should be remembered that you could not speed up the old machines without taking the temper out of the tool. The credit for the new records is certainly due to the steel.

J. A. Mathews: Our company, the Crucible Steel Co. of America, finds that we get as good results with domestic irons as with Swedish iron. We get American irons that compare well with anything that can be imported and phosphorus below .007 and sulphur below .01 are not unusual with domestic irons. We find that it is necessary to differentiate as to carbons according to the use to which the steel is put. The most efficient steel for certain kinds of cutting is found often not to be the most advantageous steel for the operating end to have to make. The data as to molybdenum which Mr. Gledhill does not have are in existence and can be had from the experience of the Crucible Steel Co. of America. We have used several hundred thousand pounds of molybdenum steel with great success. Excellent results are obtained with it when used with tungsten. We have practically confirmed what Mr. Gledhill presents in his paper and are much indebted to him for what he has given us, as few concerns are willing to make such information public.

Mr. Pye-Smith: Manufacturers of high-speed steel will be grateful to Mr. Gledhill for giving this information to users of it. The great trouble has been with this steel that users have not known how to treat it properly. This paper will be a great help in that direction. One point might be mentioned that does not appear in the paper. This steel being extremely hard and brittle, it is necessary to avoid sharp corners or angles in making tool steel. Sometimes the blacksmith in putting his stamp on this steel sinks it deeply and I have often seen a break where the stamp has been put on. Mr. Gledhill does not refer to manganese steel. Mr. Metcalf, in his "Manual for Steel Makers," makes a great point of the combining of manganese and tungsten. I should like to know if Mr. Gledhill has found the use of manganese to be detrimental or whether it improves the steel. My impression is that molybdenum is used more in America than on the other side. There are three or four molybdenum steels made here, I believe. I recently saw a trade report in one of our English journals to the effect that buying of Dannemora iron was not brisk any longer in Sheffield and apparently there was not the same use as formerly of these purer materials.

Prof. Richards: I am interested in the point as to tool steel being hard and brittle. Mr. Gledhill says .4 to .7 carbon is the most desirable quantity. The use of molybdenum involves a reduction of carbon much below the carbon content when tungsten alone is used.

Oberlin Smith: Steel makers have certainly opened to us a new era in giving us high-speed tool steel and the movement is destined to go much farther than we can now see. I am equipping a new shop which will have nothing in it but machines for the use of high-speed steel. I believe the change in machine tools due to the introduction of these steels is going to be more than we realize at present. With rotary tools, such as lathes, milling and boring machines we must have much heavier beds, frames and spindles. There must be more stiffness. But the change in these is not as great as in reciprocating tools such as shapers, slotters and planers, which are destined for almost a revolution. This will be especially marked in planers, where we have the overcoming of inertia at the end of every stroke. I believe that in the case of planers we will revert to types where the tool moves rather than the work. In many cases high-speed steels will abolish planers altogether and bring the milling machines forward to a greater extent. The development of this latter machine has just begun and in the future there will be more substitution of the milling principle for that of the planer. With a rotating tool you have the advantage of a part of the cutting edges having some chance to cool in every revolution. It is an interesting fact that the motor-driven tools and high-speed steels have come together and their problems will be solved together.

Walter Carter, of Sir W. G. Armstrong, Whitworth & Co., Manchester, England, who presented Mr. Gledhill's paper in the author's absence, replied to the discussion. He referred to the statement that it was only by building special machines that the advantages of high-speed tools could be secured. While that was largely true he had proved that high-speed steel is economical when applied to old machines. In the

case of an old planer that used to run at 17 and 18 ft. per minute the new steel had made possibly a speed of 35 to 40 ft., which means that the tool pays for itself in very little time. He had given orders to have every tool in the Armstrong-Whitworth works at Manchester equipped with high-speed steel. Referring to the records of shortened times of operations he would say that in each case both records were made on the same machine, competent operators being employed and the time being carefully taken. As to the remark made by one speaker that one brand of steel was not capable of universal application, the prominent fact that stood out was that high-speed steel beat all ordinary steel. He could bear out what had been said as to the bad effects of deep stamping and of sharp corners. The trouble had been that so many people had put high-speed steel to uses which they would never dream of for ordinary steel and then expected it to stand everything. He could not agree with what had been said by one speaker as to the future of the planer. The speed of some of the old planers in his shop had been considerably increased by the use of high-speed steels and the cost of operations reduced to about 40 percent of the former cost. Milling might be preferable to planing in some cases, but on such work as lathe beds with two tools, one on each face, the time had been shown to be far shorter with the planer than with the miller. Since the planing machine in his shop had been fitted with high-speed tools they beat the record of millers on any work over 10 ft. in length. As to the probability that there would be an increasing tendency to move the tools rather than the work on planers where high-speed tools were used he could say that this had already been done in machining armor plate in the Manchester works. As many as sixteen tools had been at work on one plate. The tools move backward and forward, cutting both ways, but they have built no such tools for work of a light nature.

More Orders for Lake Freighters.

The American Shipbuilding Co. has closed a contract with D. R. Hanna, of Cleveland, for two large freight steamers to cost $350,000 each. The boats will be duplicates of the two steamers building for G. A. Tomlinson, of Duluth, at the West Bay City yard of the company. They will be of arch construction and will have a carrying capacity of 9,000 tons.

C. O. Jenkins and others of Cleveland have contracted with the Craig Shipbuilding Co., Toledo, for the construction of a 500-ft. freight steamer for delivery next spring. The capacity will be 9,000 tons.

The Presque Isle Transportation Co., Cleveland, has placed an order with the Great Lakes Engineering Works, of Detroit, for a steamer having a length of 524 ft. over all and a capacity of 9,000 tons. The cost will be $350,000.

The Cleveland-Cliffs Iron Co., Cleveland, has closed a contract with the Great Lakes Engineering Works, for a 10,000-ton steamer of a new type. The new ship will be 36 feet shorter than the four 10,000-ton steamers which the Pittsburg Steamship Co. ordered recently, but will be four feet wider. It will be the widest boat on the lakes and will be 533 ft. over all. The cost will be $410,500.

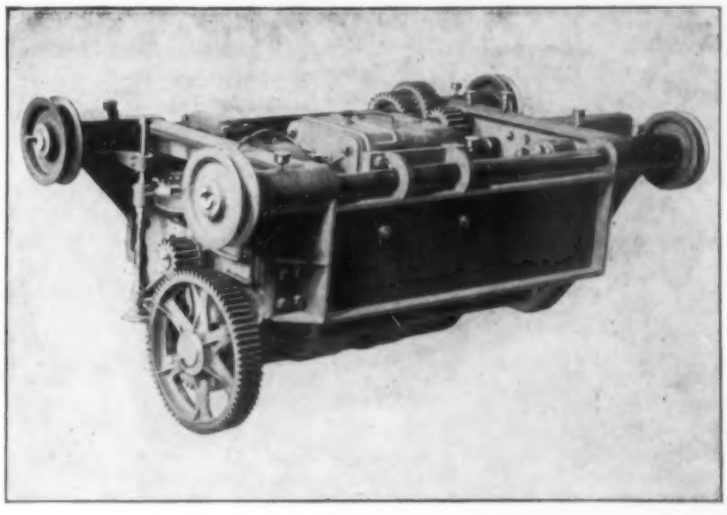
No. 2 stack of the LaBelle Iron Works, Steubenville, O., will be blown in on Thursday, Oct. 27. With this furnace in operation this company will produce sufficient pig iron for its own requirements and will also have a small tonnage to place in the open market.

The Gate City rolling mill of the Republic Iron & Steel Co., near Birmingham, resumed operations Nov. 1. About 300 men were given employment.

SPECIAL FIVE-TON ELECTRIC TROLLEY.

The Northern Engineering Works, of Detroit, has brought out a special 5-ton electric trolley. The one illustrated was designed to give the smallest possible head room above the runway rail of the traveling crane and have at the same time the greatest attainable travel on the bridge. The trolley can be made in any capacity from 2 up to 10 tons. The usual hoist speed is from 10 to 25 ft. per minute, all the hoisting gears are cut and the main hoist gears and pinion are steel. The drum has machine grooves for steel wire hoisting ropes, the standard lift is 25 ft. and the trolley and truck wheels are steel or chilled iron with machined treads. The trolley occupies only 13 ft. above the rail of the crane on which it travels. The hoist is provided with an automatic limit stop to prevent over running of the block at top of lift and also has an automatic electric brake which positively stops and controls the load when the controller handle is in the off position. The controller can be attached to the hoist and manipulated from the floor if desired but it is usually placed in the cab.

This electric trolley hoist can be furnished either with or without the crane and is adapted for overhead runways carrying material from one part of the plant to another. The



A FIVE-TON ELECTRIC TROLLEY.

standard traveling speed being 100 to 150 ft. per minute, a minimum safety factor of 5 is provided. Chain can be substituted for wire rope when preferred. The standard sizes are 2, 3, 5, 7½ and 10 tons.

The Harlan & Hollingsworth plant of the United States Shipbuilding Co. was sold last week at Wilmington, Del., by James F. Winchester, special master, to George R. Sheldon, of New York, representing the reorganization committee. The minimum amount fixed by the court was paid—$550,000 for the plant and $135,000 for the material. Among those present was Charles M. Schwab. The reorganization committee now has possession of all of the plants of the shipbuilding company.

A contract between the American Car & Foundry Co. and the Colorado & Southern railroad for the delivery by the former of 2,337 freight cars has been placed on file with the county clerk of Pueblo, Col. Some of the cars under the contract have already been delivered, while others are in the hands of the builders. The total amount of the contract is $680,035.

Some New Things for the Shop, Chiefly by Way of the Patent Office.

A Speed Changing Device.

The Patent Office continues the steady stream of variable speed mechanisms and among the more interesting of recent productions is the device invented by Francis Miller, of Bellevue, Ky. The main feature of interest to a mechanic is the simple and apparently quite effective method of locking all the shifting devices, everything being positively held from further movement except the one combination that happens to be in use and this of course is free but only to the extent of permitting a change at the pleasure of the operator.

Fig. 1 is a side elevation of the device, the cover of the gearing being removed. Two plates of circular shape enclose the mechanism at either side and are indicated at A. They have bosses projecting to right and left and these form bearings for the moveable parts. A driving shaft B is shown supported in a bearing at the left in the plate A. B is a hollow shaft with gears D and E mounted on it near one end The shaft B also carries two gears of different sizes and these are keyed or otherwise fastened to the shaft. A number of shafts between the supporting plates A carry sliding sleeves and on these are mounted the gears employed for transmission purposes. F represents a sleeve mounted on such a shaft

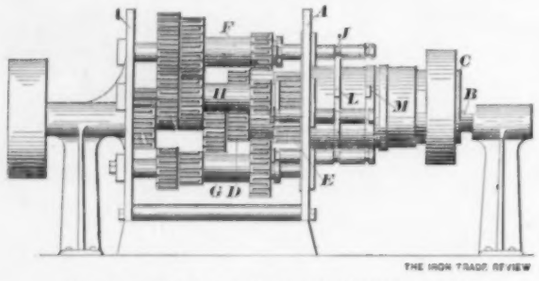


FIG. 1.—DETAILS OF SPEED CHANGING DEVICE.

and provided with three gears of different sizes. This sleeve F is freely moved along the shaft by a shifter rod provided with a collar engaging the groove in the sleeve F. Similar sleeves H and J are also equipped with sets of gears. It is evident that the gears could be fastened directly to the shafts and the latter slide through the bearings in the plates A and grooves being cut in the shafts for the shifter rod collar or other adjusting device.

A shifter rod is provided with grooves, one of which is shown at J and there is another neck near the right end of the same shaft. At the opposite end is another groove forming a rim which enters a circular recess cut in the sleeve F. The sleeve can therefore rotate freely and is at the same time connected with the shifter rod for the purpose of endwise movement along the supporting shaft. A similar shifter rod is connected with each of the other sleeves. A sleeve is mounted on the projecting portion of the plate A at the right of the device and this has a ring with a circular notch cut in the periphery at L. Another sleeve is provided with a recess for a shifting lever and has also the projection M. The parts are so arranged that only one sleeve can be shifted at a time, the other sleeves being locked while the one sleeve is shifted. The locking is effected by the ring which engages the central groove in each of the shifter rods. In order to permit these shifter rods to be moved, the sleeve is rotated until the concave opening L is opposite the shifter rod which is to be manipulated. The projection M at the same instant engages with the outer groove in the shifter rod and the sleeve carrying the finger M is then pushed the one way or the other to bring the proper gears into mesh.

The halftone, Fig. 2, illustrates a transmitter now in use on a lathe. It has a capacity of ten speeds with a ratio of 8 to 1 and with the back gears of the lathe gives a range of 20 speeds. The weight of this particular transmission

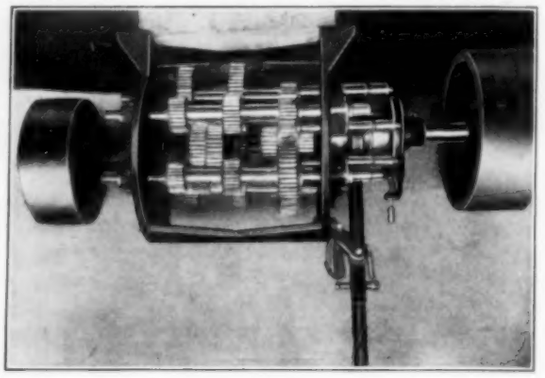


FIG. 2.—THE TRANSMITTER FOR USE WITH LATHE.

device with the two pulleys is about 225 lb. The height is 16 in., length between housings about 14 in., total length over all, about 4 ft. and is capable of transmitting 7 h. p. This transmitter for 10 speeds has five intermediate shafts with three gears to each shaft. In an 8-speed device there would be but four intermediate shafts. The halftone, Fig. 2, shows but two gears in motion. The whole of the gearing is enclosed when in use and the gears can run in an oil bath.

Holding Small Lathe Work.

This improvement has been brought out by Walter L. Abate, of Detroit, Mich., and superintendent with the McRae &

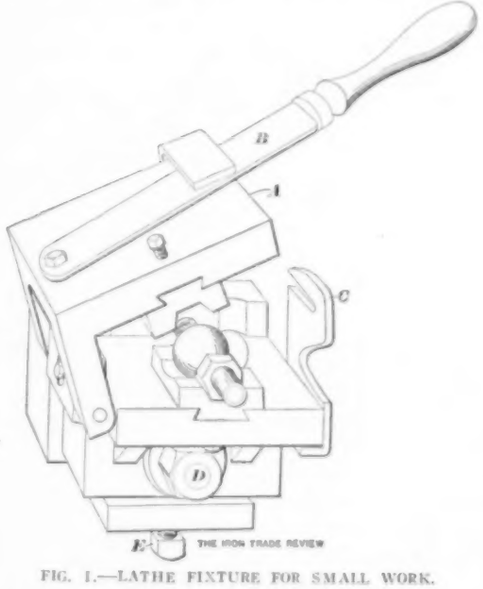


FIG. 3.—LATHE FIXTURE FOR SMALL WORK.

Roberts Co., for the rapid production of two operation work in brass and iron. Valve bodies, gas cocks, compression bibbs, round pieces—stems of valves, etc., packing nuts and probably 50 percent of ordinary brass shop work are capable of being handled in the manner proposed.

The device consists of an angle block fitted to the saddle of an ordinary turret lathe as depicted in Figs. 1 and 2. This angle block has a slide which is gibbed vertically and adjusted with a screw to any position relative to the diameter of the piece of work under operation. A clamping member A is pivoted at one side to the table by the two lugs and a flat lever B, with a handle at the one end is pivoted at the other to the clamp A. A catch C is secured to the lower half of the vise and engages the lever B when the latter forces down the upper clamp and holds it securely by insertion in the slot. The slot is slightly inclined and the hand lever when jammed into the opening holds the work rigidly. A flat

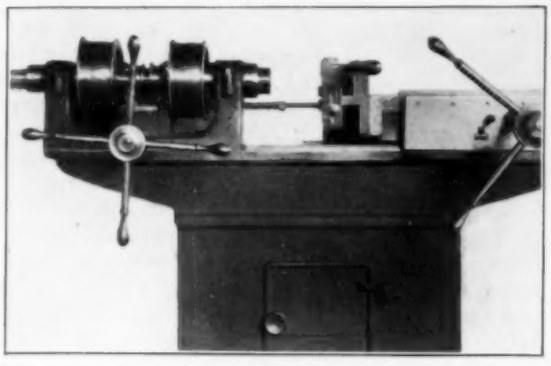


FIG. 2.—FIXTURE AND SPECIAL LATHE FOR SMALL WORK.

hook comes over the upper side of the clamping lever B and takes the strain off the pivot when rapidly opening the clamp. The bracket is adjusted vertically by loosening the bolt D and turning the adjusting screw E. Of course for this class of work the tools are run in the lathe spindle. The machine shown with the fixture in Fig. 2 was designed especially for the work and is very strong and rigid. The inventor states that recently 460 ½-in. pipe ends were milled and threaded in an hour and 40 minutes, and that 1,660 ½-in. water bibbs, shank and nose ends, were completed in 10 hours. Stems may be milled off at the rate of 600 per hour and elbows, tees and all irregular pieces are easily held in position and iron pipe nipples and round iron stock may be gripped in the clamp for threading.

The Making of Pulleys.

Albert Beran, of Hirschwang, Austria-Hungary, has taken out a patent pertaining to the manufacture of pulleys. Fig. 1 is a plan view of a block or slab of material and Fig. 2 is a complete pulley.

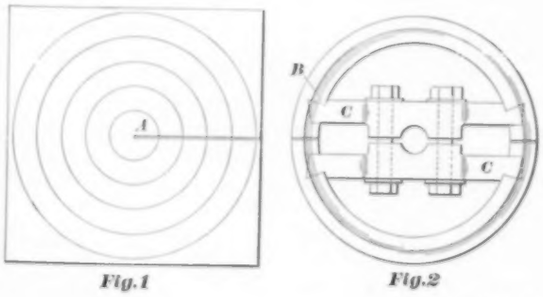


Fig.1 *Fig.2*

THE IRON TRADE REVIEW

A METHOD OF MANUFACTURING PULLEYS.

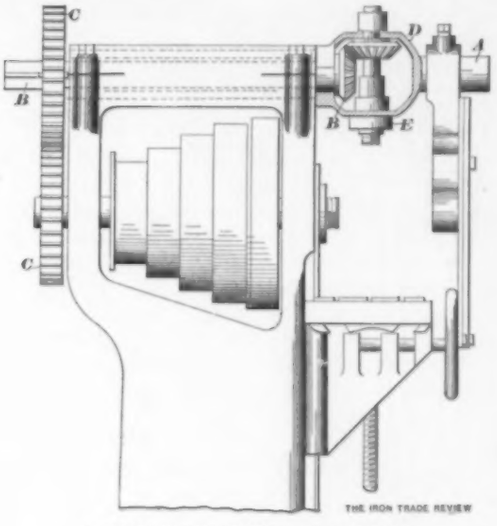
In carrying out the plan of operations, the patentee takes a block of material of suitable and uniform thickness and makes a cross cut A, as in Fig. 1, extending from side to center of the slab. The block is then divided into concentric rings by circular cuts, starting from and returning to the cross cut. A gang of band saws may be employed to divide the block into rims at the one operation. These rims are then split on a line opposite the cross cut first made at A.

The rims are next mortised to receive tenons on the ends of arms of half hubs, or transverse and dovetailed grooves B may be cut near the ends of each half rim for tenons on the spokes C which are bolted together in the usual manner when clamped on the shaft.

The inventor further states: "I prefer to make the blocks of a number of square pulp sheets or boards, as millboard or pasteboard, glued or otherwise cemented together and subjected to the required pressure to form a solid, hard, and homogeneous block in a well known manner, the number of sheets or boards used depending of course upon the width of the face of the pulley rims to be cut therefrom. I prefer this material not only because it is possible to obtain a solid, hard, and homogeneous, yet comparatively light block, but because of the frictional resistance offered by this material to the driving belt, preventing the slipping of the belt, and consequently undue heating, and insuring a more uniform angular movement of the pulley."

Vertical Spindle Attachment for Milling Machines.

An attachment for milling machines is the subject of a patent recently allowed Charles A. Rogers, of DesMoines, Iowa. The purpose of the inventor is to provide for milling machines—especially those of the knee type with an over-



A MILLING MACHINE ATTACHMENT.

hanging arm for the horizontal cutter spindle—a vertical attachment which may be thrown in or out of operation without interference with the main spindle of the miller. He locates the driving train for the vertical spindle within the overhanging arm itself as is shown in the engraving.

The frame of the miller carries the usual adjustable knee and is provided with a main spindle on which is mounted the driving cone. Above and parallel to the main spindle is the clamping support for the overhanging arm. All these are well known elements in machines of this type and need no further description.

Instead of mounting in the clamping support the common form of overhanging arm which merely steadies the outer end of the horizontal spindle and the knee, the patentee provides an arm A to which may be attached, as usual, the spindle supporting center. A driving shaft B is fitted to the arm A and has at the rear of the machine the gears C connecting with the main spindle. A housing D is located on the arm A and this is shown partially broken away to disclose the bosses E in which is journaled the vertical spindle. The upper gear C has a splined connection with the shaft B and

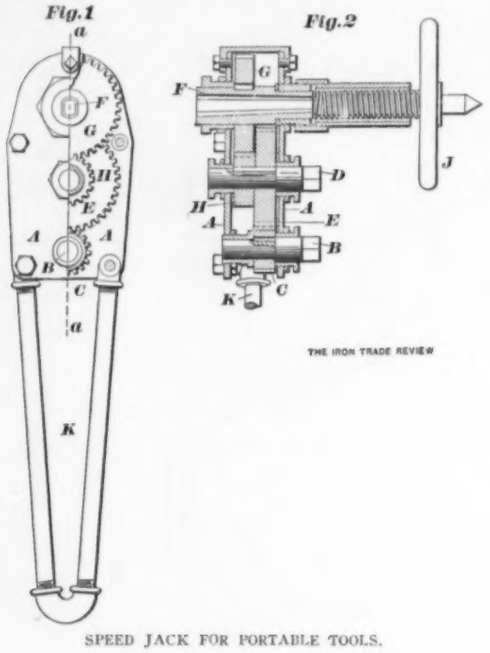
the latter is sufficiently long in order that the gear may be drawn out of mesh with the driving gear.

The usual clamp screws can be employed and an index mark placed on the arm and bearing to indicate a vertical position of the spindle. The graduations may be extended if this is desired and then the auxiliary spindle can be set at different angles easily.

Speed Regulator for Portable Tools.

The object of this contrivance is to provide an intermediate device between the motor and the taps, drills, etc. It has been patented by Erick Nelson, of St. Paul, Minn. Fig. 1 is a front elevation of the device which is partly broken away to show the gearing. Fig. 2 is a section on the line a-a of Fig. 1.

Supporting plates are seen at A and these are fastened by bolts and separated by bushings. The upper ends of the plates are connected by a clamp. A spindle B has a square end to which the motor is coupled and a gear C is keyed on the spindle. Above the spindle B is another one having a squared end at D. There are two gears on the spindle D, the larger one of these, E, being in mesh with the gear C. A third spindle F has a gear G meshing with the small gear H on D. The spindle F has a socket for the different tools



SPEED JACK FOR PORTABLE TOOLS.

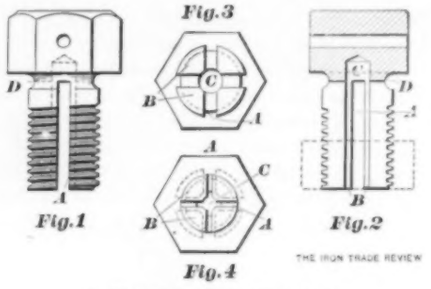
A hand wheel J is attached to a feed screw threaded within a sleeve and bearing against the spindle F.

A V-shaped pipe handle K is connected with the plates A. In operation the motor is coupled with the square head of either the spindles B or D and the tap or other tool fitted in the socket of the spindle F. A selection of either spindle in the choice of attaching the motor will give a wide variation in speed. It will be seen that the tool will rotate in opposite directions according to the choice of spindles and for some work this will require a reversible motor.

The Weakening of Bolts.

The majority of improvements in bolts, screws and other approved fastenings are directed at an increase in the holding power or convenience in application, the former receiving the greater attention from inventors. A design which has lately received Patent Office protection does not claim greater grip on the attached parts but on the contrary says "its object is to provide a screw or bolt which upon the application of a predetermined stress will automatically withdraw itself from engagement with the nut or member into which it was primarily screwed without destroying the threads of either the bolt or the nut and without permanently unfitting the bolt for further use."

Fig. 1 is an elevation of a stud bolt and Fig. 2 is a vertical section of the bolt shown in Fig. 1. Fig. 3 is an end view of the bolt in its normal form and Fig. 4 is also an end view of the bolt but showing it in the form it is caused to take when automatically disengaged from the nut. It is intended that the bolt will yield under a definite strain but without injury and that if used for holding down a cylinder head for example, the head is to withstand all normal forces but will leave the cylinder safely in the event of an excessive load being applied. The threaded bolt has the strain resisting surface of the threads formed to an angle of less than 90 degrees from the vertical axis of the screw. The end of the bolt is slotted as at A, completely separating it lengthwise and forming a number of prongs as at B. When such a bolt is screwed into a nut or other member it will withstand such strains as the resistance of the prongs will offer to the inward thrust due to the angle of the thread and when this resistance is overcome the prongs will collapse as in Fig. 4. The prongs are likely to take a permanent set if the bolt is made of the material usually employed for that purpose. If, however, stock of sufficient resiliency is used the prongs will spring back when drawn free of the nut, and in order to facilitate this action the patentee prefers to definitely weaken the bolt under the head by a groove at D and the flexure is then confined to this section and does not take place at the threaded portion. The prongs may be weakened by increasing the width or num-



A NOVELTY IN STUD BOLTS.

ber of the slots or by drilling a hole in the center of the bolt at C. The prongs so far as that goes could be made to collapse or deflect under a greater or lesser load by varying the angle of the face of the thread with respect to the bolt's axis. The tops and bottoms of the threads can be rounded or flattened as indicated in the engravings.

Citizens of Oakland, Pittsburg, held a meeting last week and raised a fund for the purpose of prosecuting the Jones & Laughlin Steel Co., alleging that the ore dust injunction has been violated. It is asserted that all the dust from the company's blast furnaces has not been abated since the order of the court was issued. The company has been doing everything in its power to abate the trouble and has been working all furnaces slowly to prevent the slips which scattered the dust.

The Union Furnace Handle Co., Morrell, Pa., has completed its buildings and has in operation the most modern machinery for the manufacture of "D" handles. The power for operating this machinery is furnished by the Union Furnace Mfg. Co., whose entire plant is operated by water power. The main building of the Union Furnace Handle Co.'s plant is of solid concrete, 40 x 70 ft. The capacity of this plant is about 150 dozen "D" handles per day.

The Pere Marquette railroad is considering the advisability of moving its engine shops from Muskegon to Grand Rapids, Mich.

Some Novelties from Germany.

BY ROBERT GRIMSHAW.

Double Lathe Tool Carrier.

The illustrations show a wheel lathe in the celebrated Hartman locomotive shops in Chemnitz, Saxony. The peculiar feature is the tool support which dispenses with auxiliary tool-holders. The worm A, Figs. 2-5, the bronze worm wheel B and the vertical arbor C, Fig. 3, which last runs in phosphor bronze bearings, are driven in the order named by a chain. The hardened steel pin D guides the gear wheel E, Figs. 3 and 5, which is in one piece with the vertical arbor C, in the groove of the cast steel profile guide piece F, Figs. 3 and 5. The gear wheel E is always in mesh with the rack of the pattern or guide piece F. This rack is built up of studs. The movement of the pin D along the line of the pattern or profile piece F is communicated through the two cross slides G to the cuting tool.

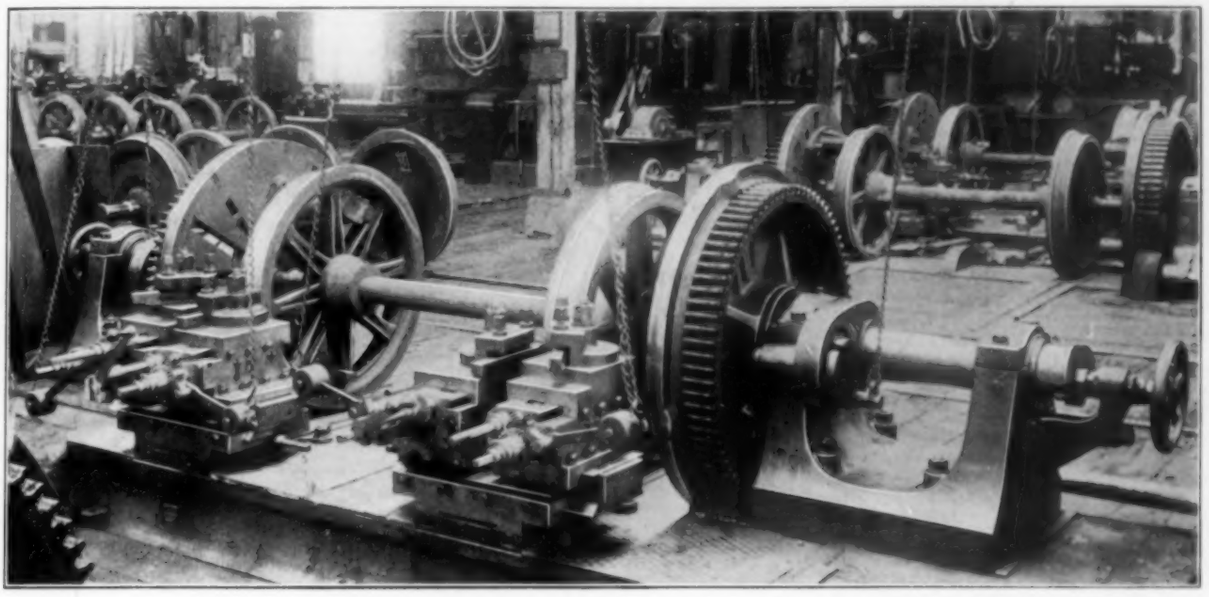


FIG. 1.—A WHEEL LATHE WITH FORMING ATTACHMENT.

The spindles H are used to adjust the tools. The two slides are given the desired irregular movement independently of each other.

If it be desired to turn the plane surfaces of new wheel tires with the device, the clutch couplings J are released when the appropriate positions of the slides are reached, and the gear wheel K shifted over, bringing this latter into mesh with the wheel shown in Fig. 2. If, however, there are already auxiliary slides for this work, the special slide is delivered without the arrangement for face turning, and the parts J, K, etc., are omitted.

The cavity of the slide L, in which are placed the profile pieces or guides, is filled with oil and kept closed by the slide G and by sheet-steel plates M. The only exposed portions are the chain shifting-gear, all other parts running in oil baths.

The motion of the cross-slide is not affected by sliding the guide pin along the pattern piece F (as in the Suchanek and other profile lathes); but both slides G are actuated by the gear wheel E. The pin D gets only the pressure resulting from its guiding the two cross slides. The gear wheel E always moves in the direction of the lathe tool.

Equivalents and Their Logarithms.

The table given in Fig. 3 shows in very compact form the equivalents of each of ten different units of surface—both metric and British—in each of the other nine; further, gives the five-place logarithms of each multiplying factor. Thus we see opposite "sq. mm." (or square millimeters), and under "sq. mm." a 1; opposite "sq. mm." and under "sq. in." 0.00155; indicating that one square millimeter equals 0.00155 square inch. The logarithm of this multiplier or factor 0.00155 is minus 3.19033. Similarly we find that one acre = 0.404687 hektar; and that the logarithm of 0.404687 is minus 1.60712.

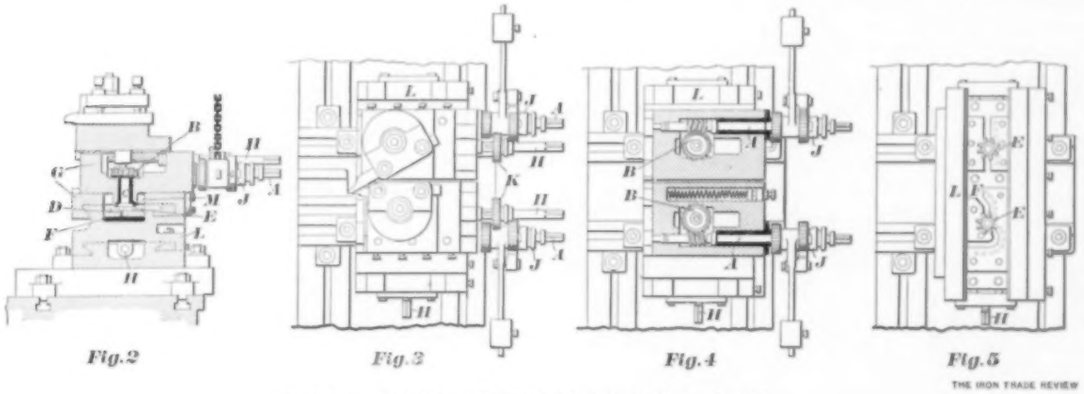


Fig. 2 Fig. 3 Fig. 4 Fig. 5

THE IRON TRADE REVIEW

DETAILS OF FORMING ATTACHMENT FOR WHEEL LATHE.

Suppose now we want to reduce 15.34 square kilometers to square miles. It can be done either (1) so:

0.386101
15.34

1544404
1158303
1930505
386101

5.92278934 or say 5.93 sq. miles;

or (2) so:

log. 0.386101 = — 1.58670
log. 15.34 = 1.18583

log. Product 5.923 = 0.77253

Plans for the Bethlehem Plant.

In a recent interview, Charles M. Schwab explains to some extent his plans for the future of the Bethlehem Steel Co. Mr. Schwab says:

"Sir James Kitson, the great British steel man, remarked after a visit to the United States that the steel manufacturers in America have gone in for vast tonnage, and left to England the manufacture of the highest kinds of steel. It is my purpose to put the Bethlehem steel works into this niche, and to take a field in the United States heretofore largely unoccupied. What I shall strive for at Bethlehem will be to see how well we can do things, and how far we can develop the business and art of steel making. Highest quality will be the motto, and to attain this we shall employ the most skilled workmen to be found. The Bethlehem is not adapted so much for great tonnage output as it is for the production of fine steel. We shall not make rails there, but the plant will be developed and largely extended for work of other descriptions. In a word, I intend to make the Bethlehem the prize steel works of its class, not only in the United States, but in the entire world. In some respects the Bethlehem Steel Co. already holds first place. Its armor plate and ordnance shops are unsurpassed, its forging plant is nowhere excelled, and its machine shop is equal to anything of its kind. Additions will be made to the plant rather than changes in the present process of method of its manufacturer."

Units	Equivalents and their Logarithms									
	Sq. Mm.	Sq. Cm.	Sq. In.	Sq. Ft.	Sq. Yd.	Sq. Me.	Ha.	Acre.	Sq. Km.	Sq. Mi.
Sq. Mm.	1	0.01 2.00000	0.00155 3.19033	0.0001292 4.11116	——	——	——	——	——	——
Sq. Cm.	100 2.00000	1	0.155 1.19033	0.012917 2.11116	0.001435 3.15685	0.0001 4.00000	——	——	——	——
Sq. In.	645.163 2.80957	6.45163 0.80967	1	0.00694 3.84164	0.0007383 4.86823	0.0000645 5.80956	——	——	——	——
Sq. Ft.	92903.4 4.96803	929.034 2.96803	144 2.15836	1	0.1 1.04576	0.0929034 2.96803	0.00000934 6.96803	0.0000229 5 5.36078	——	——
Sq. Yd.	——	8361.296 3.92227	1296 3.11261	9 0.95424	1	0.836131 1.92227	0.00008361 3.92227	0.0002066 4.31513	0.000000836 7.92227	0.000000632 7.50515
Sq. Me.	——	10000 3.00000	1550 3.19033	10.7639 1.03197	1.19599 0.07773	1	0.0001 4.00000	0.0002473 6.39722	0.000001 6.00000	0.000000386
Ha.	——	——	——	107639 5.03197	11959.9 4.07773	10000 4.00000	1	2.47104 0.39288	0.01 2.00000	0.003861 3.58670
Acre	——	——	——	43560 4.63909	4840 3.68485	4046.87 3.60712	0.404687 1.60712	1	0.00404687 3.60712	0.0015625 3.19382
Sq. Km.	——	——	——	10763900 1.03197	1195989.1 5.07769	1000000 6.00000	100 2.00000	247.105 2.39288	1	0.386101 1.58670
Sq. Mile	——	——	——	28778400 7.44527	3197600 6.49103	2590000 6.741330	259 2.41330	640 2.80618	2.59 0.4133	1

FIG. 3.—TABLE OF EQUIVALENTS AND FACTORS.

The Innovator.*

BY FRED J. MILLER.

We metal workers and machinery builders are, it seems to me, placed in a unique position with respect to those matters which have to do with the public weal. We are the innovators par excellence. We live by asking others to accept new ideas; to discard the old things and take up the new. Our efforts to have men do these new things are at least fairly successful: not as successful as we sometimes wish them to be, but still in the main quite successful, and the fact that men discard old ways of doing things and adopt our new ways, not only keeps our machine shops and other metal working establishments busy and enables us to earn our bread and butter (and sometimes a little cake) but it produces the most profound effect upon the manner of life of all men. It continually disturbs and upsets the established order of things, throws a lot of men entirely out of employment here, radically changes the nature of the employment of a lot of men there, creates the opportunity for the employment of a lot of men elsewhere and continuously and rapidly increases the amount of wealth that can be produced by a unit of labor in a unit of time. No other class of men whatever, it seems to me, are continuously doing so much to change the currents of human life; to make important that which before had been unimportant; to make valuable that which before had been without value and, per contra, to sometimes render almost if not quite valueless, things which have had value. A very large part of the work of lawyers, doctors, ministers, legislators, statesmen, educators and philosophers is to keep up with the changes brought about in their respective fields of effort by the never-ending innovations of machinery builders.

It seems to me that because of the profound and far-reaching effect of the introduction of machinery, if on no other account, we as a class owe it to ourselves and to our fellow men, to give some attention to affairs of a public and social nature. Especially it seems to me should we, as far as possible, endeavor to maintain open minds with regard to what others of our fellow citizens are thinking. We, who deal in innovation, so to speak, and who know something of the diffi-

*An address delivered at the recent meeting of the Cincinnati Metal Trades Association. Mr. Miller is editor of the American Machinist.

culty of inducing men to take up new ideas which we feel confident they ought to take up, and which subsequent experience proves they ought, may well be careful how we prejudge the new ideas of others in different fields; ideas presented by men who in the final analysis are doing the same thing as we are always doing, i. e., really thinking and endeavoring to improve things instead of accepting everything as we find it and taking it for granted either that it has always been perfect or that it must necessarily always be beyond the possibility of improvement.

Most important, it seems to me, is it that here in this country and among our citizens in every walk of life, we should be careful to preserve the right and the custom of the freest possible expression of one's honest views, not only through freedom of the press and free speech as ordinarily understood, but by that higher form of freedom of speech which avoids any form of coercion or prejudicial action against a man who freely and candidly speaks his honest mind on a public matter.

To see the results of the opposite course one needs only to look at Russia, where no writer or speaker may safely give expression to his real thoughts and where any tyrant however cruel, or any policy however bad, is free from public criticism; where in short not only the tariff but every other public question is so effectually "taken out of politics" that no one is allowed to discuss them or to have any voice in their settlement. Those of you who have been in Russia know that in that country official corruption is carried further than in any other of the leading countries of the world. This is probably not because Russia officials are worse at heart than those of other countries, but because, no matter what an official may do there, he feels sure that no newspaper will criticise him. Officials there may say as much as they please that for reasons of state public affairs must not be openly and freely discussed in Russia, but it is mainly for reasons of graft and because the rascals know full well that freedom of the press would certainly result in exposure of their doings and loss of their official, if not their actual heads. And so one of the kindest-hearted and naturally best disposed people in the whole world are driven to the use of the murderous dynamite bomb as their only means of making any impression upon those who so cruelly oppress them. In Russia no new ideas are welcomed, and the innovator is sternly repressed.

The most successful innovator of modern times appears to be Japan. For fifty years her history has been a continuous series of what to her people must have been the most startling innovations. They have accepted them all calmly, adapted them to their purposes and made greater progress during the last half century, all things considered, than was ever made by any other nation in three times fifty years. And what seems to me especially commendable in their attitude toward the spirit of progress is that they have welcomed ideas from foreign countries. They have done and are still doing what their emperor in his oath taken at the restoration in 1868 said they would do: "We shall henceforth seek knowledge and wisdom in the civilized world and establish the National Assembly where the important affairs of state shall be decided by public opinion." It will be well for our own country if we follow an equally broad-minded policy with respect to ideas of foreign origin. We have adopted the secret ballot from abroad, hoping particularly that it would help us in freeing ourselves from the political boss. Let us cheerfully and with open minds examine the Swiss initiative and referendum which in Switzerland has been proven to leave no opportunity for the baneful activities of the political boss; besides which it automatically disfranchises those unfit to vote upon a given question. From Switzerland and from most of the other countries of Europe as well we can get knowledge of the working of government ownership or government controlled operation of railroads, telegraphs, telephones, street cars and other things which are the necessities of modern civilization, but in which from the nature of the case there can be no such thing as free competition and the private ownership of which has been demonstrated to be a most potent cause of official corruption. My plea is simply that we keep ourselves open to conviction with regard to all these things. For us they would be innovations, but let us not reject them on that account nor because they came from foreign lands. Many of the best things, the best people and the best ideas come from foreign lands, and he is not the best kind of an American who would reject them on that account.

We have, and probably always shall have, a certain proportion of well-intentioned citizens who will instinctively oppose any such new-fangled ideas; who will resolutely shut their eyes to every evil connected with the present systems and keep them fixed fast upon the difficulties, some real and some purely imaginary, of the new plan. Every sort of reason and argument they will give you against a change or an attempt at progress in any direction, except the real reason: this real reason being in fact unperceived by them because it is within themselves and consists of their own fixed and ineradicable horror of everything and anything that is new to them.

You all remember that dear old conservative Uncle Remus and the fearsome times he had in his encounters with the telephone and the phonograph and the trolley car, and how vividly he illustrated the fear of an untutored mind when brought into contact with things that are new and therefore distressing. As machinery constructors we are as far as possible from being like Uncle Remus. We welcome new things and new ideas and we devote much time, effort and money to the propagation of our own new ideas, to the end of having other people adopt them and, incidentally, to pay us a little something for them.

In view of this fact and the further fact alluded to before, that these new ideas are producing the most profound effect upon the lives of others, should we not therefore be especially careful not to adopt the common way of the world and be narrow-minded and obstinate in our attitude toward the innovations of others in other fields of thought?

A matter of growing importance, it seems to me, and one in respect to which we machinery men can do much good, is to help towards a clearer perception than now prevails of the difference between competitive and non-competitive business organizations and enterprises, between free business and monopolized business. On the one hand we find many people regarding as monopolies practically everything in the way of large or prosperous business enterprises; especially if they are composed of a number of previously separate enterprises that have been combined under one ownership. On the other hand we find those who deny that there are any monopolies whatever and insist upon it that if people would not only stop talking of such things there would be no monopolistic problem. As often happens in these matters the truth seems to lie somewhere between these extremes.

There are many lines of business which can be carried on here by anyone with perfect freedom upon terms of free and equal competition. There are very many lines of manufacture in which it is perfectly practicable for anyone having or being able to enlist the needed capital and brains to enter with the same chance that the new man has always had in going into competition with old established houses. I dare say that in the case of most, if not all, of the industries represented here tonight a new competitor commencing tomorrow would have no unfair competition to meet. He would be able to buy materials upon the same terms, to receive and dispatch freight upon the same terms and to hire skilled and unskilled labor upon the same terms, as are enjoyed by those already in the business. What more can a new enterprise reasonably ask? Even where all the business in a given line is owned and operated by a single company, and there is what is commonly referred to as a trust, still so long as that trust does not control or monopolize the supply of raw materials, so long as

anyone who wishes to compete with it can get exactly the same rates of transportation over railroads and steamship lines, there is no real monopoly. Such a company must operate in view of potential if not actual competition because there is plenty of capital and plenty of labor to undertake the business whenever there seems to be in it promise of good returns. This means that the business must be conducted with due regard to the fact that competition will certainly, sooner or later, be brought into existence, unless things are so conducted as to make it apparent that buyers get a share of the benefits resulting from whatever of economy there may be in the wholesale doing of things in the elimination of the ruinous and expensive methods of competition that we have heard so much about. All this applies to department stores, machine tool building shops, engine shops, etc., no matter how large they may be, but it does not apply to such concerns as the Standard Oil Co., the anthracite coal trust, the United States Steel Corporation, the copper trust, and similar organizations, which either control exclusive supplies of raw materials or necessary lines of transportations, or both. Nor does it apply to railroads, street railroads, gas, water and electric lighting companies, which must operate under a franchise and carry on a business of such a nature that there can be no such thing as free competition, either actual or potential.

In attempting to distinguish between real monopolies and competitive enterprises we need not be misled by the fact that some companies and individuals are both monopolists and conductors of competitive business, as is the case with the United States Steel Corporation and the Standard Oil Co., nor need we join in the hue and cry against monopolists as individuals, who in fact usually do nothing more than take advantage of opportunities offered to them by a foolish people who do not sufficiently look after their own interests. But what we do need to do is to help in spreading abroad a clearer idea than is now prevalent as to the difference between competitive business enterprises, however large and prosperous they may be, on the one hand, and on the other hand monopolies of all kinds—special privilege in every form, whether at present profitable or not, by which the equal right to life, liberty and the pursuit of happiness (with any prospect of catching it) is to a greater or less extent invaded and abridged.

Certain men attempt to excuse themselves from the consideration of these matters by saying that success or failure depends entirely upon the individual. "If a man does not succeed it is entirely his own fault and no one is to blame but himself."

Some years ago I stood in the gallery of a well-known machine shop in Philadelphia, which had then been recently reconstructed. Very heavy traveling cranes had been installed and upon the floor below, as I stood beside one of the proprietors looking down upon it, was a group of men packing parts of a large machine for shipment abroad. At the moment four of the men were standing idly about while a fifth gave the necessary signals to the crane man for lifting from the floor and depositing in a packing box a part of the machine that could not have weighed over 100 pounds and that any two of them could have lifted and placed in a fourth of the time required for the crane to do it. I spoke of it and the proprietor said: "Yes, I am naturally inclined to worry about such things, but Mr. Miles always says never mind such doings unless you can prevent them. You must not expect these men to have the same judgment and ambition we have. If they had they would not be working for us for $1.75 per day, but would be our competitors and perhaps bothersome ones."

Chauncey Depew, when speaking before bodies of railroad men, used to be fond of declaring that "Opportunities are equal here in America. Any one of you may become president of the New York Central R. R." Well, so any one of them could, but not a thousand or a hundred or even a dozen of them could be. The vast majority of such men must remain in the humbler positions. There can be but one president of the New York Central R. R., while there must be thousands performing manual labor—tamping ties and driving spikes. Moreover, deny it as we may and as some of us do, we have come to that stage of industrial progress here in which many thousands of such men feel quite certain that they will continue to do such work throughout all their working days. They know as everyone else knows who talks with these men and notes their capacity for arithmetic, for business, or for intrigue and wire-pulling, that they really cannot be presidents of railroads even if there was a demand for so many. When such men, feeling sure that they must, throughout all the working portion of their lives, do nothing but work similar to that they are now doing, endeavor, by fair means or foul, to bring about what they consider will be better terms of employment, it does no good whatever to tell them about the ambition they ought to have and the heights of achievement to which they may attain. An employer threatened, or whose rights as a free-born American citizen are invaded by such efforts, must of course defend himself as best he may, but neither from the standpoint of ethics nor of expediency should the old argument about there being "plenty of room at the top" be presented as a remedy for general or class difficulties. It is all right for the individual who feels within himself the capacity to rise, but for the masses, what they believe they need is more room at or near the bottom, where, after all, most men must in the nature of things remain and toil for a living. Whether it is better that it be so, or not, I believe the time is coming, if it is not already here, when in practice it will be the custom for employers and employes to frankly deal as such and as men expecting that in general their relations are to be permanent.

I do not, of course, mean that it is the duty of employers to provide this increased room at the bottom, but it is the duty of American citizens to provide it by every possible proper and fair means, and it does seem to me that machinery builders ought to be the last to obstruct proper efforts to that end, as in fact most of them are among the last.

We may be sure that all has not been done that might be done or that ought to be done to provide this increased room at the bottom until we shall have heard the last of over-production—until machinery shall no longer be accused of producing so many and such great quantities of good things to eat and to wear that thousands must suffer for lack of them, i. e., for opportunity to exchange their labor, or the products of their labor, for the things they need.

We may be sure that all has not been done that can be done and that ought to be done to provide this increased room at the bottom until we have seen the last of the anomaly of able-bodied men, idle, suffering privations, willing and anxious to work, but finding no man to hire them, while unused materials of nature lie idle, being by any means whatever rendered inaccessible for the employment and use of labor and capital. I say until these strange and self-contradictory and abhorrent phenomena are no longer to be observed, it is certain that our political economists, our statesmen and our legislators are not keeping abreast of the progress made by science and the arts, especially with the profound effects of the ever-increasing use of machinery. Until these things are done away with there will be no rest, and there ought not to be, for no thinking man can believe otherwise than that they indicate a maladjustment of the great social machine which governs our relations to one another and also the distribution of the joint product of labor and capital co-operating in the work of transforming the raw materials of nature into things of value and use.

Recently in an address delivered before the Engineers' Club of Philadelphia, Dr. Henry Leffman treated of Washington as an engineer. We all know he was at least a surveyor, however much of an engineer he might in this day be considered to have been. But he was essentially an innovator. He

presented, steadily maintained and heroically fought for a new idea, i. e., that all men should be equal before the law, that no man by reason of birth and without regard to his own merit should demand or receive honor or tribute. A lesson for us of today is to be found in the attitude of society toward Washington and the cause he represented. Almost unanimously what we should now call "the better element" was bitterly opposed to him. He and his followers were the hoboes and ragamuffins of the day. Nearly all the clergy, all the office-holders and most of the property holding and educated classes were his bitter enemies, and did everything they could to prevent the ideas he represented from making headway and becoming triumphant. Of the graduates of Harvard College then living an overwhelming majority were Tories, and that which perhaps more than any other one thing enhances the glory of Washington is the fact that to do the work he did he had to break away from most of those who were in his station in life, he being one of the very few patriots who possessed wealth and who with the others could so easily have persuaded himself that, he and his being well situated, well able to pay the tax on tea, buy stamped paper, etc., there was no necessity for making a fuss over such trifles and perhaps getting shot or hung for your pains. "Let well enough alone; let Tom Paine and the other poverty-stricken rapscallions prate about 'common sense,' and liberty and equality before the law, and the humbuggery of the divine right of kings, if they have nothing better to do. I have something better to do. I am thoroughly well able to take care of myself; if others are not it is their own fault." That could so easily have been Washington's attitude and if it had been the name of Washington would today have been as thoroughly unknown as are the names of his contemporary property owners and beneficiaries of the established order of things who hated new ideas and all who advocated them. Canada would have extended to the Gulf of Mexico and the people of England themselves would today have far less of political liberty and be far less prepared for future advances toward the highest citizenship; it being now quite generally recognized that Washington fought for the rights of humanity in England as well as in America, and that the surrender at Yorktown was as much a victory for the people of England as for those of our own land. Washington was an engineer; but his immortal fame is based upon the fact that he welcomed new ideas outside of engineering and that he was an innovator.

In the shops we find men of widely varying attitudes toward new things and new ideas. The majority perhaps are indifferent to and uninterested in them. Such men do for the plodders and they perform the most of the routine work in accordance with plans laid down by others.

Other men espouse new ideas simply because they are new and seem to think that any new thing must necessarily be better than the old. Such men occasionally advocate a good new idea, but it is more by chance than anything else. They seem unable to discriminate between the good and the bad and would as quickly disrupt the entire organization of a shop and revolutionize its methods for a bad thing as for a good one, if it be only different from the old way.

At the other extreme we find the men who instinctively resist and oppose every new proposition, no matter what it may be, and finally the men who carefully but candidly consider; who maintain the open mind; give every new idea or proposition due consideration; adopt such of them as seem likely to be of service and especially see to it that the new ideas do not conflict with the general plan of the establishment and do not render useless or less effective some other good idea already in use. These last are the men that are most valuable in the shop and such men are undoubtedly most valuable as citizens when they apply these principles to civic problems, in respect to which there must be progress, but progress that is, so to speak, conservative, a growth toward greater liberty and greater opportunity for the individual to unrestrainedly develop himself. There is in public matters the same need for the open mind in our attitude toward new things that there is in the shop toward new ways of doing work. There must be progress or stagnation and decay. I believe we shall progress, socially as well as industrially, and in this progress I would see the men who supply the world's machinery take a prominent and an honorable part.

AIR COMPRESSORS FOR THE NEW YORK SUBWAY

The daily traffic service of the New York subway contemplates the operation of two tracks carrying local trains at one-minute intervals and two more tracks with 8-car express trains at two-minute intervals. The safe handling of trains in such number and frequency offered problems in signal work almost unparalleled in railway history. A system has been worked out and applied which practically guarantees the safety of the traveling public. This is a development of the well known electro-pneumatic switch and signal system used for years with success on the great railways of the country. In the operation of this system electricity and compressed air have joined forces. Electricity is the directing force, compressed air the actuating power. The reliability of any switch and signal system depends upon the reliability of its sources of power. The electrical appliances offer nothing of decided novelty, they are standard. But the air compressors are unique in design and are worthy of description.

The machines were built by the Ingersoll-Sergeant Drill Co., of New York. They are two-stage machines with horizontal intercooler, fitted with the Ingersoll-Sergeant piston inlet valve. Nine compressor units have been installed and three more are under construction. Each compressor is connected by a Morse silent chain to a 35-h. p. Westinghouse direct current motor taking current from the lines at from 400 to 700 volts. Motor and compressor units are on solid subbases. At rated speed of 120 r. p. m. each unit has a capacity of 215 cubic feet of free air per minute compressed to 80 pounds pressure. The compressors are automatically controlled and regulated by the air pressure. Working pressure on the system is maintained constant within 5 pounds of the fixed standard. When receiver pressure falls below normal a combination of electrical currents operates to bring the compressor to speed with no load. When normal pressure is reached on the system the machine is unloaded and the motor cut out. Arrangement is also made whereby the starting and stopping of the unit automatically starts and stops the flow of intercooling water and lubricating oils. Compressed air from these machines which are located in substations is distributed through 2-in. pipe lines running the length of the system and operates various signal mechanisms, pneumatic switches, automatic train stops, etc. The electrically-driven air compressors with their automatic control and regulation are ingenious safeguards, and their performance under the extremely arduous service conditions in the subway is an interesting commentary on the "dependable" quality of the modern air compressor.

The American Steel Foundries have received a number of large orders for steel castings, notably castings for 51 engines for the San Pedro, Los Angeles & Salt Lake road, averaging some 12 tons per engine; for 1,200 tons of castings for the Blackwell's Island bridge and for bolsters for upward of 7,000 freight cars.

The Canadian government has awarded another contract for 10,000 tons of steel rails to the Lake Superior Corporation. This makes 20,000 tons which the Soo company is to supply for the Intercolonial. The rails are to be delivered at Montreal.

NEW MOTOR DRIVEN LATHE.

The Lodge & Shipley Machine Tool Co., of Cincinnati, has a new lathe with patent head and other interesting features to be seen in the two illustrations here presented. The particular lathe shown is of 16-in. swing but the design is applicable to all the machines built by the Lodge & Shipley Machine Tool Co. The motor on this 16-in. lathe is 2½ h. p., Northern type, and geared 2 to 1. The patent head shown gives three changes —the two mechanical changes on the driving shaft make six variations and this capacity with the 2 to 1 motor gives a very wide range.

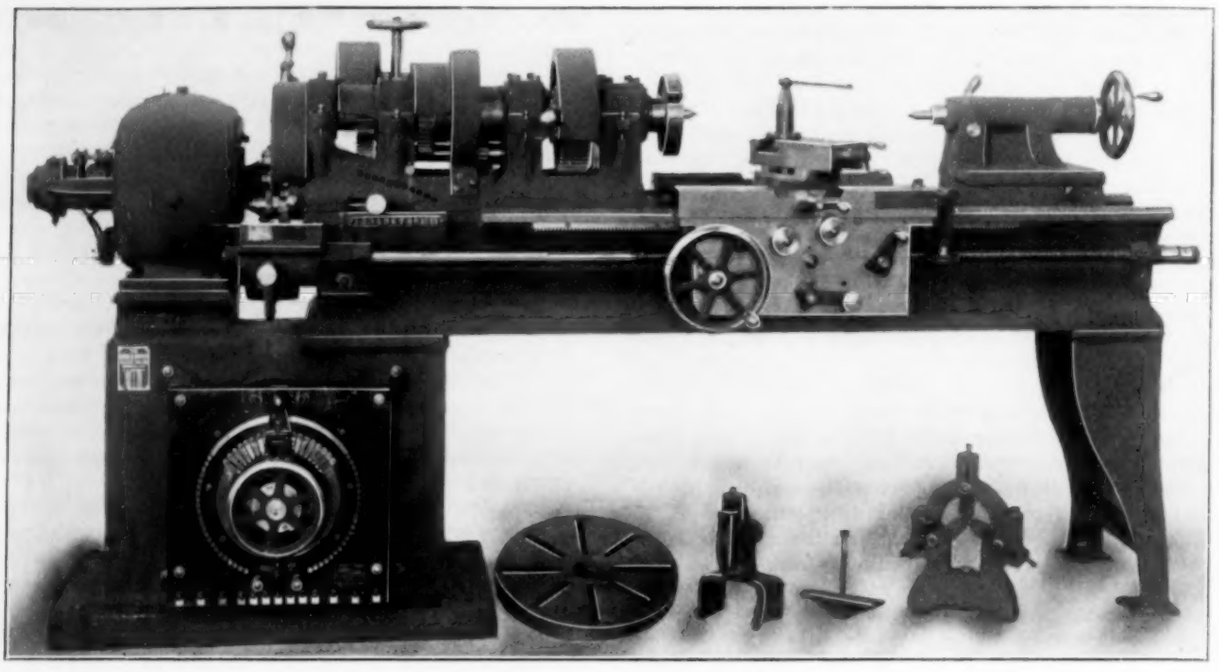


FIG. 1.—MOTOR-DRIVEN LATHE WITH PATENT HEADSTOCK.

As regularly made the controller is operated from the carriage and not as shown. The lathe can be furnished with a pulley suitably supported in place of the motor and then the machine can be operated from the line shaft directly with six changes of spindle speed. The salient features of the tool are the mechanical simplicity and neatness of appearance. There is also in this combination all the benefits of the recently patented lathe head by which high speeds with heavy cuts, heretofore impossible, are easily obtained.

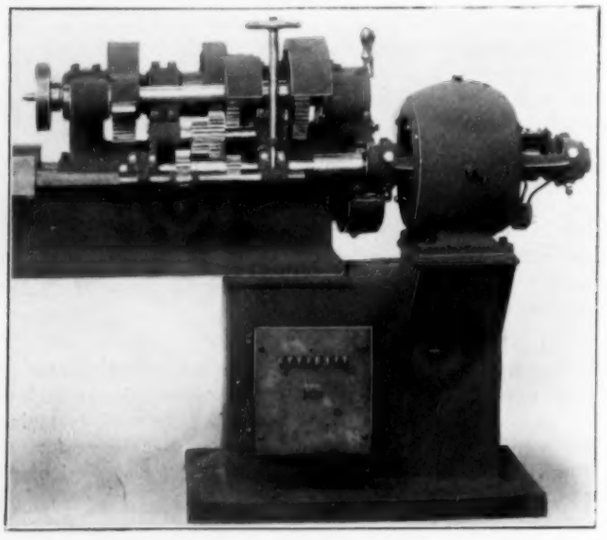


FIG. 2.—REAR VIEW OF LATHE WITH PATENT HEADSTOCK.

Canadian Notes.

Toronto, Canada, Nov. 1.—W. P. Coleman, president and general manager of the Canada Car Co., organized with headquarters at Montreal and a capital of $3,000,000, states that an immense plant will at once be erected near that city. The buildings are to cover 360,000 square feet, and it is hoped to commence operations early in the summer. The plant will be on the combination principle and capable of turning out 55 cars a day—25 wooden, 15 steel and 15 passenger coaches, in addition to steel under frames and truck frames. From 1,500 to 2,000 men will be employed. Though the principal incentive to the enterprise is the prospective demand of the Grand Trunk Pacific, the company expects to do a large export trade in addition to supplying Canadian requirements.

The first locomotive of the modern type built in Toronto was turned out of the Canada Foundry Works this week. It was constructed for the Canadian Pacific Railway and is the first of a large order for locomotives for heavy freight traffic.

The Kingston Locomotive Works has received an order from the Grand Trunk Railway Co. for 25 locomotives of the Richmond compound Mogul type, to be delivered within the next 18 months at a cost of about $400,000.

Inspector W. E. H. Carter, of the Provincial Bureau of Mines, reports that at Loon lake, east of Port Arthur, Ont., a good deal of work has been done on the iron range by Flaherty & Knobel, Wiley & Co. and R. McConnell, with the result that considerable hematite has been shown to exist. The district is likely to develop as a mining region. Prof. W. G. Miller, provincial geologist, has made a preliminary investigation of the iron range in the township of Boston, in the Temiskaming district of New Ontario, and finds the range not so wide as those of the Temagami region. The ore is magnetic.

The town of Preston, Ont., has voted a loan of $15,000 to the Metal Shingle & Siding Co. to enable it to erect new buildings and replace the plant which has been twice destroyed by fire this year. The company will build a large fireproof plant near the Grand Trunk Railway depot.

New York Meeting of the Iron and Steel Institute.

Our report of the technical sessions of the New York meeting of the Iron and Steel Institute, given last week, stopped in the midst of the discussion of the paper of James Gayley on the application of air blast to the manufacture of iron.

In his discussion of the paper, E. S. Cook, of the Warwick Iron & Steel Co., Pottstown, Pa., stated that his experience with moisture in the blast furnace dated back to 1888 or 1889, and he referred to the many conversations and discussions he had had on this very subject with Mr. Gayley when the latter was "an ordinary blast furnace engineer." At Pottstown, after collecting a large quantity of data on the subject, the speaker had got to the point where he believed the variations in moisture furnished the key to many of the fluctuations to which the blast furnace is subject. With the engineer of his company, Mr. Cook had sought a solution of the moisture problem. They figured on using chloride of calcium and drying out by absorption, but the cost of the drying plant and the operation of it were so expensive that they gave up in despair. Mr. Gayley was entitled to great credit for having solved a problem which others had recognized but had considered impossible of solution. At Pottstown the records of the Warwick furnaces showed that at different seasons of the year the amount of water dissociated in the operation of smelting varied all the way from 150 lb. to 450 lb. per ton of iron. They had found as much as 10 to 11 grains of moisture in the atmosphere per cubic foot of air. This moisture increases very rapidly as the atmospheric temperature rises, and these variations in the amount of moisture made great changes in the furnace. "One advantage I see in this solution offered by Mr. Gayley is this," said Mr. Cook; "at a meeting of blast furnace men at Philadelphia last week the opinion was expressed that the blast furnace industry was the only one in which it was a crime to make money, the idea of the buyer of pig iron being, apparently, that a bare living was about all the blast furnaceman was entitled to. This invention of Mr. Gayley will add just so much to our investment and leave us about where we were before, so far as profits are concerned."

Andrew Lamberton, of Coatbridge, Scotland, said that this invention was just the thing blast furnacemen were looking for. They were urgently in need of something that would decrease the cost of pig iron, and in that direction alone could he see hope for development. The speaker asked whether in the experiments at Isabella furnaces there had been any difference in the time the blast was kept on the stoves before changing. He would suppose this time would be lengthened with dry blast.

Axel Sahlin said that in 1895 he was connected with the Maryland Steel Co.'s blast furnace at Sparrow's Point, where the atmosphere was more humid than the average in the United States. They suffered much in their practice from the lack of uniformity in the moisture content of the air. Their thoughts turned toward some cure for this trouble, but no definite steps were taken. Mr. Gayley had an advantage in being backed by the ample capital of a great corporation, and with power unchecked by a board of directors in the matter of expenditures for new economics. At Sparrow's Point it was found that the air inside of the blowing engine house carried considerably more moisture than the air outside, this being due to the leaking of steam pipes, etc. At the suggestion of F. W. Wood they had encased the air cylinders of the blowing engine with a shell and conducted air into the shell from the outside. They found a great saving from this method.

Chemical Composition and Tensile Strength of Open-Hearth Steel.

Another noteworthy paper of the morning session was that of H. H. Campbell, general manager of the Pennsylvania Steel Co., on "The Influence of Carbon, Phosphorus, Manganese and Sulphur on the Tensile Strength of Open-Hearth Steel." The introduction to the voluminous data contained in the paper recites the extensive calculations made at Steelton 10 years ago, with a view to deriving formulæ for the calculation of the tensile strength of steel from its chemical composition. Then follows a statement of the more recent and very extensive determinations made at Steelton to check the first investigation. The paper is given up to a series of tables and platted diagrams detailing the results obtained in the testing of various groups of bars, classified first according to carbon and then sub-divided according to their content of managanese, phosphorus and sulphur, respectively. The introductory statement is as follows:

"Many attempts have been made to write a formula by which to calculate the strength of steel from its chemical composition, but most of these endeavors have failed because there were too many disturbing conditions. It is idle to collect from the pages of trade papers, books, or the proceedings of scientific societies, a multitude of observations. The combination of such results will simply show that steel of the same composition will vary in tensile strength through wide limits—a fact that has been known for generations. That cold working, overheating, and many another form of heat treatment alter fundamentally the strength of steel, is ancient history, although it is only recently that the microscope has pointed out the road to an explanation of the phenomena.

"It may be urged that the microscopic structure must be taken into consideration in any formula giving the ultimate strength, but from the standpoint of the present investigation this is unnecessary. We are trying to determine primarily, not what changes in ultimate strength may be made by variations in the condition of carbon, but what effect is produced by changes in the amount of carbon, when its condition remains constant. For such an inquiry, in order that the condition of the carbon should remain as nearly uniform as possible, it is essential that all test-pieces be made under the same conditions; and it is believed that the tests described in this paper satisfy that requirement. The investigations were made at the works of the Pennsylvania Steel Co., Steelton, Pa. The ingots from which the tests were made were 6 in. square in every case; they were heated in the same furnace and forged at the same hammer into billets of the same size; these billets were reheated in the same furnace by the same men and rolled in the same set of rolls into 2 by ⅜-in. bars of about the same length. These were cooled under the same conditions, broken in the same machine by the same men, and analyzed in the same laboratory by the same staff.

"About ten years ago extensive calculations were made on such bars at Steelton by the method of least squares. In this

H. H. CAMPBELL.

Harry Huse Campbell was born in West Roxbury, Mass., March 10 1859. He graduated from the Massachusetts Institute of Technology in 1879 and the same year entered the employ of the Pennsylvania Steel Co., at Steelton, Pa., and has been with that company ever since. He has been general manager since 1901. He invented the first tilting open-hearth furnace; also produced low phosphorus acid open-hearth steel by the transfer process, the steel being used in the new East River bridge. His monumental work, "Manufacture and Properties of Iron and Steel," represents the results of a noteworthy career as metallurgical engineer and steel works manager, and is one of the classics of steel making that will long endure.

case the bars of similar composition were grouped together, and the carbon of the group was determined by combustion upon a sample containing an equal amount of drillings from each bar. Such a grouping of the tests would give rise to error if unlike bars were put together; so that this was avoided as far as possible. A greater cause of trouble lies in the fact that, in the method of least squares, any error in one factor affects the other factors. If for any reason the value of phosphorus comes out higher than the real truth, the value of carbon may suffer accordingly. Still greater is the objection that no factor can be used in the work unless it really has a decided influence on the results. This was illustrated when sulphur and copper were used as factors, the values found for them being absurd.

"In acid steels, it appeared that carbon and phosphorus were the important elements to be considered; and it was assumed that the strength of steel was made up of the effect of a certain content of iron, plus the effect of a certain content of carbon, plus the effect of a certain content of phosphorus. Thus in a metal containing 0.20 percent of carbon and 0.08 percent of phosphorus, and having a tensile strength of 70,000 lb. per sq. in., we may write the following equation (the iron being determined by difference):

20 C + 8 P + 9,972 Fe = 70,000; C, P and Fe being constants, representing the effect upon the tensile strength in pounds per square inch of 0.01 percent of carbon, phosphorus and iron respectively. In this way each group of tests furnished a formula and the combination of these by the method of least squares gave the following results:

"*For acid steel:* (C = 1,210; P = 890; Fe = 38,600.)

38,600 Iron + 1,210 Carbon + 890 Phosphorus + R = Ultimate Strength.

"*For Basic Steel:* (C = 950; P = 1,050; Fe = 37,430, and Mn = 85.)

"37,430 + 950 Carbon + 1,050 Phosphorus + 85 Manganese + R = Ultimate Strength.

"The iron, carbon, phosphorus and manganese are expressed in units of 0.01 percent, and R, as well as the ultimate strength, in pounds per square inch. R is a variable, to allow for heat treatment. In angles and plates, about ⅜ in. or ½ in. in thickness, and finished at a fairly high temperature, R is zero.

"In this formula Fe, 38,600, represents the value independently determined for pure iron. From a mathematical standpoint there can be no objection to including iron as one of the factors in the problem, but practically there are the following reasons to the contrary:

"1. There is a doubt whether the real basis of strength varies with each increase or decrease in the total metallic iron. It may be that the datum-plane is the same, whether the steel contains 99.6 percent or 99.1 percent of iron.

"2. Since the iron is determined by difference, all the errors in determining carbon, manganese and phosphorus, as well as the total contents of sulphur, copper, silicon, and other elements, may make a composite error of no small moment; and this is all embodied in the figure representing iron.

"3. The range of variation in the percentage of iron is not sufficiently great to give a good working basis.

"Notwithstanding all these objections to the methods of determination, the derived formulæ given above have been of the utmost practical importance. They have been applied to every heat of steel made by the Pennsylvania Steel Co. for the last ten years; and there has rarely been, in the ultimate strength of soft steels, a difference of more than 2,500 lb. per sq. in. between the result given by the formula and the record of the testing-machine. In most cases the error has been much less than 1,500 lb.; and so great is our confidence in the formulæ, that chemical determinations are always repeated when they are not confirmed by the machine test. In view of such an experience in every-day commercial work, it would be rash to say that the method is entirely wrong, or that the formulæ do not represent actual conditions.

"To check the first investigation, two entirely new series of bars were collected: one of nearly 700 from acid heats, and the other of 1,100 from basic heats. Duplicate determinations were made on each bar for phosphorus and manganese. The carbon was determined in three ways: (1) the bar was analyzed by combustion (duplicate tests being made in case of doubt); (2) the bar was analyzed by the color-test; (3) a piece of the ingot from which the bar had been made was cut off at the hammer, and analyzed by the color-test. Three bars were pulled on each heat, two on one testing machine and one on another. The figure used is the average of the results obtained on the two machines, not the average of the three bars. In order to plot the data, all heats were combined which showed carbon from 0.075 to 0.125 percent; from 0.125 to 0.175 percent, and so on—making a division for each additional 0.05 percent of carbon."

Conclusions.

The conclusions are thus stated:

"*Carbon.*—In acid steel each 0.01 percent of carbon strengthens steel by 1,000 lb. per sq. in. when the carbon is determined by combustion. The strengthening effect is 1,140 lb. for each 0.01 percent as determined by color, owing to the fact that the color-test does not determine all the carbon present.

"In basic steel each 0.01 percent of carbon strengthens steel by 770 lb. per sq. in. when the carbon is determined by combustion. The strengthening effect is 820 lb. for each 0.01 percent as determined by color.

"*Phosphorus.*—Each 0.01 percent of phosphorus strengthens steel by 1,000 lb. per sq. in.

"*Manganese.*—Each 0.01 percent of manganese has a strengthening effect upon steel, and the effect is greater as the content of carbon increases. Below a certain content of manganese the effect is complicated by some disturbing condition, probably iron oxide, so that a decrease in manganese in very low-carbon steels is accompanied by an increase in strength. In acid steel each increase of 0.01 percent in manganese above 0.4 percent raises the strength of acid steel an amount varying from 80 lb. in a metal containing 0.1 percent carbon to 400 lb. in a metal containing 0.4 percent carbon. In basic steel each increase above 0.3 percent raises the strength an amount varying from 130 lb. in a metal containing 0.1 percent of carbon, to 250 lb. in a metal containing 0.4 percent of carbon.

"*Sulphur.*—The effect of sulphur on the strength of acid and of basic steel is very small.

"*Formulæ.*—From the foregoing results the following formulæ may be written, in which C = 0.01 percent of carbon, P = 0.01 percent of phosphorus, Mn = 0.01 percent of manganese, R = a variable to allow for heat-treatment, and the answer is the ultimate strength in pounds per sq. in. [The coefficient of manganese in acid steel, called x, is the value given in one of the author's tables and applies only to contents above 0.4 percent. The value of manganese in basic steel, called y, is the value given in another table, and applies to contents above 0.3 percent.]

Formula for acid steel, carbon by combustion:

40,000 + 1,000 C + 1,000 P + x Mn + R = Ultimate Strength.

Formula for acid steel, carbon by color:

39,800 + 1,140 C + 1,000 P + x Mn + R = Ultimate Strength.

Formula for basic steel, carbon by combustion:

41,500 + 770 C + 1,000 P + y Mn + R = Ultimate Strength.

Formula for basic steel, carbon by color:

42,000 + 820 C + 1,000 P + y Mn + R = Ultimate Strength.

Discussion.

Wm. R. Webster, of Philadelphia, opened the discussion on Mr. Campbell's paper, presenting the following:

"We are under great obligations to Mr. Campbell for his exhaustive investigation, and the results he has put before us today. They are the most complete series of tests that have ever been made where all the conditions of rolling, etc., were kept uniform. In discussing Mr. Campbell's first investigation I claimed: First, that the method of least squares, then used,

would of necessity only give the average value of any element, and that if the effect of any element was greater in the presence of high carbon than with low carbon, this would not be shown by the method of least squares; second, that the effect of manganese should be considered on acid steel, as well as on basic steel, instead of ignoring all the effects of that element when it was below .60 percent, as was then recommended by Mr. Campbell. I am pleased to note that the results of his present investigation confirm my views on these points.

"In presenting the results of his first investigations, Mr. Campbell referred to my investigation of 1893-4, and took exception to the value of phosphorus varying (depending on the amount of carbon present) from 800 lb. to 1,500 lb. for each .01 percent. He claimed that one might just as well consider the effect of phosphorus as being constant, and of carbon varying. I refer to this, as he now has introduced very similar conditions in his present tables, in that he gives variable values for manganese (depending on the amount of carbon present) for both acid and basic steels. Can we now say with any more certainty than formerly which element should be considered as having a constant effect?

"There is one other point that I took up in my former discussions. It is the matter of grouping the tests together, and getting an average of each element in the steels of the group, and from these average results working out the values. I worked with the individual tests and analyses, and consider them much better. I trust Mr. Campbell will give us the full results for each individual test, in order that others may be able to work out the values for each element by their methods. This, no doubt, would result in bringing into line the views of the different investigators on this important subject. For instance, would not the individual tests and analyses assist in deciding whether phosphorus should vary from 1 to 1⅞ times the effect of carbon, as I have it in my paper before this institute in 1894? Or should the effect of phosphorus be constant, and that of manganese vary in accordance with the amount of carbon present, as Mr. Campbell has it in his present paper? But of course it is much better to keep the effect of carbon per unit constant under all conditions, if possible, as that is the element we depnd on the most.

"Mr. Campbell's present investigation will greatly assist in harmonizing the work of others, as they have all worked with the method of 'successive approximations,' that is, 'cutting and trying,' and it will now be a very simple matter to compare results. In my own case I have no disposition to insist on the former value given for each element, which, though based upon numerous careful observations, and proved by many subsequent tests to be approximately reliable in practice, are still open for correction, and will be unhesitatingly withdrawn whenever any others shall be shown to fit the observed facts more closely. The practical value of the estimated ultimate strengths is now recognized by the steel manufacturers and they use them in their every day work. The color carbon determinations are used on account of the quickness of the method."

[Mr. Webster next calls attention to tables he had prepared, putting Mr. Campbell's results in convenient form for comparison with those of Mr. Cunningham and himself. One of these, table A, was prepared in 1902. It gives the values for each .01% phosphorus up to .08%, in connection with each five points of carbon from .06% to .60%, and each five points of manganese from .20 to 60 percent. Another, table B, had been worked out on the same general lines as table A, using Mr. Campbell's new values for carbon, phosphorus and manganese for acid and basic steels, and the carbon by both color and combustion.]

"A comparison of these results shows that nothwithstanding the differences of the values of each element used by the different investigators, the estimated ultimate strength by the different methods agree much more closely than we would expect. It would therefore seem to me that this matter will yet be very much simplified. For instance, have we enough data before us to say that the same amount of carbon in acid steel has from 30 to 40 percent greater effect than in basic steel. In the present case this greater value for carbon in acid steel is compensated for by giving the manganese a much greater value in basic steel, and also by using a higher value for pure iron in basic steel than in acid steel.

"The factor 'R' given in all equations as a variable to allow for heat treatment, is of the most importance, as it has considerable effect on the physical properties of the steel. Formerly it was much neglected, but since the mills have been grading the steel by the estimated ultimate strengths, the heat treatment in rolling has been much more closely watched. In 1894 I made a strong plea for an investigation to be made on the heat treatment of steel, in connection with the work of rolling and forging. A great deal has been done in this line since then, but there is much still to be done.

"I agree with Mr. Campbell that it is not necessary to take the microstructure of the steel into consideration, from the standpoint of his investigation. Yet anything that will in any way assist in controlling the heat treatment of the steel should be looked into. In the ordinary microscopical work, they have not tied up the fractures of a nicked and broken piece of steel, as we know it, with the microstructure of the same steel. This step from the old to the new has long been needed, and I now desire to call attention to a method of slight etching and low magnification with a hand glass that is very promising. It looks as though by this method we will be able to tie up the fractures of the nicked and broken pieces with the etched structure of steel of, say, .50 percent carbon and under. The pieces shown herewith are from the same bar of .35 carbon acid open-hearth steel. One piece was overheated and shows the large coarse structure; the other piece was overheated and then annealed. It shows a much finer structure. A test of this kind would be useful in the case of large driving axles, as a small spot could be polished and etched. The glass would show if the steel had been finished at too high a temperature in forging, that is, if it had too large a grain, and in a dangerous condition.

"This method of investigation is offered at this time as a suggestion, in the hope that others will take it up and improve on it."

Dr. Dudley, of Altoona, Pa., was called on to follow Mr. Webster. He said it had been known for years that there was a relation between the chemical and physical properties of steel. The testing department of the Pennsylvania Railroad had got more information from the examination of steel that had failed in service than from any other source. A tensile test was made if possible, also a chemical analysis. For a long time they had found a ratio existing between the physical test and the chemical analysis, and to put this in definite shape had been a work of tremendous importance and infinite labor. At times it was not possible to make a tensile test of a broken part, as there was not enough of the metal. In such cases an analysis was made and then the analysis interpreted into the physical character of the steel.

In closing the discussion Mr. Campbell said in reply to Mr. Webster's suggestion, that the detailed list of heats was not given because there were 1,800 heats represented and this would take up too much space in the transactions. Full records would be furnished for any calculations Mr. Webster might wish to make. In reply to his further criticism that the difference in value of carbon between acid and basic steels can be accounted for by the difference in the value of the base, Mr. Campbell said that this acounts for a small part of the difference, but only a small part. For one particular content of carbon the formula would give the same result if the base were changed and the value of carbon were changed, but with a steel of .30 percent carbon the difference in the base accounts for only a fraction of the difference

made by the two values of carbon. The tests embrace steels with a considerable range of carbon and no change of base will give correct values for the ultimate strength of the steel. That can only be done by assigning proper values for the carbon in each case.

The other papers read at the morning session were those of Prof. H. Bauerman on "Iron and Steel at the St. Louis Exposition," C. V. Bellamy on "A West African Smelting House," and P. J. Mallmann on "A Power Gas Plant for Johannesburg."

The afternoon session was devoted principally to the paper of J. M Gledhill, of Manchester, Eng., on "High-Speed Tool Steels," a synopsis being presented by Walter Carter, of the Armstrong-Whitworth Works at Manchester, in Mr. Gledhill's absence. A liberal synopsis of the paper together with the discussion on it appears in another column of this issue.

The paper of E. Demenge, of Paris, on the "Rateau Low Pressure Turbine at Steel Works and Colleries," and that of Andrew McWilliam and W. H. Hatfield, of Sheffield, Eng., on "Acid Open-Hearth Manipulation," were read by title.

In the closing moments of the session resolutions of thanks to the American committee and all who had contributed to the pleasure of the visitors during their stay in New York, were presented and supported in hearty seconding speeches. The response was made by Geo. W. Maynard, of the New York committee. Thanks were also voted to Andrew Carnegie, the retiring president.

THE INSTITUTE DINNER.

The annual dinner of the Iron and Steel Institute was given in the grand ballroom of the Waldorf-Astoria on Wednesday evening, and was a brilliant affair. About 300 members and guests were in attendance, the banqueters being seated in groups of eight at round tables, while across the end of the room stretched the speakers' table. At this table sat, in addition to President Carnegie, E. Windsor Richards, E. P. Martin, Sir James Kitson, Sir Lloyd Wise, W. Whitwell, Joseph Wharton, S. T. Wellman, Ambrose Swasey, Sir David Stewart, T. Clifford Smith, Sir Percy Sanderson, Dr. R. W. Raymond, George W. Maynard, Gen. Mills, J. W. Lieb Jr., A. Lamberton, C. Kirchhoff, R. E. Jennings, R. W. Hunt, Dr. Alex C. Humphreys, Prof. H. M. Howe, James Gayley, John Fritz, Sir Walter Foster, James Douglas, W. E. Corey, Edward Cooper, Rear Admiral Coghlan, C. A. Coffin, B. H. Brough, John Birkinbine.

The menus were striking in illustration, the front cover having a lurid representation of an old-time open-top furnace. Two large photogravures adorned the interior pages, one representing the modern tall building, the rapid transit line and other great engineering works in New York as playthings of the aboriginal American, personified by an Indian papoose. The other pages showed a latter-day sky scraper, "Menu Building," under construction, the different stories representing courses of the dinner, the names of the viands appearing on the front of each story. When the ices were carried in, in procession, representations of great engineering works were borne on the shoulders of the waiters, these figures including the new 42nd street and Broadway flat-iron, the skeleton of a tall building, a generator, a man-of-war, an engine, etc.

The patriotic toasts were first given by President Carnegie, who called upon the diners to stand and drink in one toast to the two rulers of the English-speaking nations who stood for international peace. At the same time the orchestra played "America" and "God Save the King." Mr. Carnegie commented on the drinking of this combined toast as probably the only time on record when it had been given in this way.

The sentiment "The Reception Committees" was proposed by Sir James Kitson, who recognized the obligation of the visitors to three persons in particular—Mr. Fritz, Mr. Kirchhoff and Mr. Dwight, of the American committee. He referred to England as glad to see her young son rushing forward victoriously in the industrial race, while on the other side they were doing their best to hold their heads above water. These meetings of the Iron and Steel Institute meant something more than the pleasure and instruction they gave, for they made for the solidarity of the Anglo-Saxon race. The speaker referred to letters which poured in upon him from friends in the United States at the time of "threatened trouble over some trumpery of a South American state." These letters told him that nothing serious could come out of it all, and gave assurance that peace would be kept. "And peace was kept, and these international meetings of the Iron and Steel Institute had something to do with it." Referring to the incident in the North Sea, the speaker expressed the belief that in the hour of need the Anglo-Saxon race would unite to keep open the high seas to the commerce of the world and not permit irresponsible marauders to attack defenseless fishermen who were peaceably pursuing their calling.

In acknowledging the toast, Charles Kirchhoff, chairman of the American executive committee, said that the closer relations of the visitors and their hosts had given both new light. The visitors had improved on acquaintance, and this more cordial feeling might be taken as a symptom that the Yankee was no longer regarded as so great a braggart or so erratic as many on the other side once thought him to be. The changes of 14 years had suggested that the child on this side was getting too heavy to sit in the lap of his British forbear, and that for mutual comfort it would be better for the two to stand side by side. The speaker alluded to the specimens of the genus octopus that had made their appearance in this country since the last visit of the Institute, with a keen reference to the way in which they had disported themselves in their native element. Electricity, meantime, had started a violent flirtation with the son of Vulcan, and the hope was expressed that the relation would do the cub some good. The speaker referred to the steel manufacturers of the leading countries as making progress side by side as friendly rivals. It is the desire of their friends on this side that the visitors may be convinced that American iron and steel manufacturers are worthy of British teachings of the past, and that Americans are attempting more than to brutally develop their great natural resources, aiming rather to excel in their skillful utilization. The speaker hoped that the visitors might acknowledge, as a result of their tour, that the American iron industry is making progress along sound lines.

The toast "Our Guests" was proposed by E. Windsor Richards, past-president of the Institute, and was acknowledged by Rear-Admiral Coghlan, U. S. N., and Dr. Alex C. Humphreys, president of Stevens Institute of Metallurgy. Mr. Richards referred to the Institute as an association incidentally spoken of 14 years ago as the "British Iron and Steel Institute" Though cosmopolitan then, the organization is even more so now. He referred in warm terms to American hospitality, the various visits of the Institute to countries apart from Great Britain showing that the American people were second to none in that particular. Rear-Admiral Coghlan spoke of the Institute as representing the greatest victories gained in the world in the past 25 years. "We have to have a few of your products occasionally," he said. "Some of them are small in their way, but they help us along tremendously." We have profited greatly by your studies and by the interchange of your ideas. We know that by such meetings together great progress results and hope that this will continue always.

Dr. Humphreys referred to the awards of the Bessemer medal as showing entire freedom from local or national prejudice. He discussed rather sharply the statement in a recent speech of the German emperor, that the reason Great Britain and the United States were so far behind in industrial lines was their lack of technical training. In the same connection German technical progress was given pre-eminence. The speaker

claimed a better appreciation in the United States of the necessity of combining the technical and the practical. Of late the iron and steel manufacturers of the United States have keenly apprehended that practice needs constantly to be checked by well developed theory.

"The American Engineering Societies" was proposed by E. P. Martin, past-president of the Institute, and acknowledged by Dr. Henry M. Howe, of Columbia University. Mr. Martin referred to the great difficulties encountered 40 and 50 years ago in the effort to obtain reliable scientific information. A vast change had come in the interval. Information is now poured out in such quantities that its classification would be difficult if it were not for the assistance of such societies as the Iron and Steel Institute. These organizations also brought technical information into such form that it could be readily digested. Referring to the palatial dwelling the engineering societies of the United States were soon to have, through the munificence of Mr. Carnegie, the speaker felt inclined to break the tenth commandment and covet a similar dwelling for the Iron and Steel Institute. Prof. Howe, in referring to the names which stood for engineering progress in Great Britain, mentioned Watts, Stevenson, Nasmyth, Cort, Bessemer, Siemens and Martin. "We owe to you, also, every invention of the first rank in the metallurgy of iron and steel, puddling, the pig washing process, the hot blast, grooved rolls, the steam hammer, Bessemer steel, open-hearth steel (acid and basic) crucible steel and the rest. * * * These trans-Atlantic excursions are of great value to mankind in that they make for the ascendancy of our Anglo-Saxon civilization by helping the two nations to understand each other."

The Iron and Steel Institute.

Dr. R. W. Raymond, secretary of the American Institute of Mining Engineers, proposed the toast, "The Iron and Steel Institute and Its President." He said in part:

"The Iron and Steel Institute was organized in 1869. Thirty-five years is a small period to compass such a career and to deserve and win such world-wide recognition as this society has achieved. At the inaugural meeting, held in London, June 23, 1869, its first president, the Duke of Devonshire, delivered an admirable address, sketching the history of the manufacture of iron, noting the steps of its progress, and indicating its situation throughout the world. That address recognizes as already in use and likely to become widely important, the large blast furnace, the brick stove for heating the blast, the Bessemer converter, the open-hearth steel process, the general substitution of rolls for hammers. Whitworth's casting of steel under compression, together with some other inventions, which afterwards more or less disappointed the expectations then entertained concerning them. Moreover, with singular acuteness, it calls attention to the unfavorable effect of the relatively low density and high humidity of the air blown into the blast furnace during warm weather, an evil which, by a happy coincidence, is to receive its latest discussion and its first effective remedy through the paper of Mr. Gayley at this meeting of the Institute.

"But neither the Duke of Devonshire nor any one else realized the extent of the flood which was to come from the springs he noted. At the time of his address the world's production of pig iron was, in round numbers, twelve million tons, of which Great Britain produced something less than half; the United States, Germany and France about one-eighth each, and the rest of the world the remainder, a little more than one-eighth. Last year the world produced nearly forty-seven million tons of pig iron, of which Great Britain, though she had increased her output 63 percent, furnished not quite one-fifth, while the United States, with an increase of more than 900 percent, contributed much more than one-third, and Germany something more than one-fifth, an increase of 613 percent. Now, it was in Great Britain that most of the factors of this progress originated, and it is evident that the grand result, like the rise of the Nile, has been exhibited far from its original sources.

"I have said that no one realized in 1869 the extent of this coming flood. But justice requires that I should call attention to the remarkable prescience shown a little later by Abram S. Hewitt, whom the Institute honored in 1890 with the Bessemer medal. In an address of welcome to the American Institute of Mining Engineers, delivered in this city in May, 1872, Mr. Hewitt prophesied that in 1890 the world's product of pig iron would be 28,000,000 tons—it was 27,630,000 tons; that it would be at the beginning of the 20th century more than 40,000,000 tons—it was 40,499,786 tons; that the product of the United States in 1897 would be 10,000,000 tons—it was 9,652,680 tons; and that the annual product of this country at the beginning of the 20th century would be 15,000,000 tons—it was 14,960,000 tons. I venture to say that our theological friends, if they could produce such a verification of the declarations of an Old Testament prophet, would deem it conclusive proof of divine inspiration. To me it is a proof that, even outside of the biblical list, the divine power, through the operation of the laws it has ordained, may grant to a pure, lofty, disinterested and reverently and profoundly inquiring spirit the ability to read the future.

"Far be it from me to boast of the extraordinary progress of my country in this field. In the first place, that progress has been chiefly based upon virgin resources, for the possession of which we can claim no credit. It was totally without knowledge of the future value of the Lake Superior iron ore deposits that the boundary line between us and Canada was so drawn as to give us almost all of those deposits, upon which our vast iron industry now so largely depends. In the second place, if I were inclined to boast, I should be checked by the reflection that one of the chief agents in the extraordinary development of the American iron and steel business has been that cosmopolitan captain of industry, now president of the Iron and Steel Institute, Mr. Andrew Carnegie, whose merits and achievements have just been recognized by the conferment of the Bessemer gold medal, to my mind one of the greatest distinctions which human hands can place upon a human breast, and by the election of whom as its executive officer the Institute has declared that its labors and its rewards are not limited by political boundaries. And, finally, I must bear witness, for every one of the students and practitioners who have contributed during the last thirty-five years to the development of the iron and steel industry of the United States, that they have always looked to the Iron and Steel Institute for sympathetic and helpful criticism, guidance and inspiration. Whatever success we have achieved may justly be added as a jewel to the crown of fame which that society has fairly earned and may proudly wear.

"In that priceless Volume I. of the Journal of the Institute, the first technical contribution is a paper by Isaac Lowthian Bell 'On the Development of Heat and Its Appropriation in Blast Furnaces of Different Dimensions.' I need not say what a profound effect that paper, with its successors, produced upon the metallurgists of the world. To this day no man is competent to write upon the interior reactions of the iron blast furnace who has not first mastered the classic discussion of that subject by Sir Lowthian Bell. Not only to me as an ardent and grateful personal friend, but also to every one of you, it must be cause for gratitude that this far-seeing, undaunted, wise and generous pioneer and teacher is still preserved to us, in mental power unimpaired by age, as it is cause for regret that we cannot see once more among us, as so often heretofore, his benign and noble face. I might fairly apply to the Institute the famous epitaph of Johnson upon Goldsmith (only no *epitaph* would be appropriate to a career still so vigorous and fruitful), and say that there is no subject of importance to the sciences and art connected with iron and steel which the Institute has not treated, and that it has

treated nothing which it has not adorned. In every step of that progress, the fruits of which we enjoy, it has taken an influential part. It is not the Iron and Steel Institute of Great Britain, it is the Iron and Steel Institute, representing us all!"

Mr. Carnegie spoke in eulogy of two members of the Institute who participated in the meeting of 14 years ago, but not in that of 1904—the late Abram S. Hewitt, one of the most eminent of Americans, and Sir Lowthian Bell the Nestor of the Institute, who could not make the trip across the Atlantic. Mr. Carnegie asked that a toast be drunk in silence to the memory of the former and asked that the secretary of the Institute cable a greeting to Sir Lowthian Bell on behalf of the assembled company. In bringing the evening's program to a close the president spoke regretfully the word of good bye adding the quaint Scotch appeal, "Will ye no' come back again?"

Successful in every particular, the dinner will be memorable among engineering banquets in the United States, and high praise is given Mr. T. C. Martin, chairman of the committee in charge. In his hands such an affair becomes a reality, a signal feat in engineering.

To Philadelphia and Washington.

The greater part of the visiting party left New York Thursday morning, Oct. 27, for Philadelphia. A smaller number went to South Bethlehem by special train to visit the plant of the Bethlehem Steel Co., where the open-hearth department and the forge and armor plate department proved of special interest. The equipment of the latter, which has been equal to the casting and manipulation of a 104-ton ingot, and the great presses in the forging plant were features especially noteworthy. The plant of Worth Bros. at Coatesville was also inspected by a number of the visitors. Friday morning they assembled at the mayor's office and were formally welcomed by Mayor Weaver. Sir James Kitson responded to the mayor's welcome. Then the visitors were driven in tallyhos and barouches in different directions. One party drove to the Delaware and boarded a steamer on which they visited Cramps' and the New York Shipbuilding Co.'s plants and League Island Navy Yard. Another party visited the Baldwin Locomotive Works, the mint and other places about the city. The largest party, which included Sir James Kitson and Sir Walter Foster, went to Independence Hall, the Commercial Museum, the University of Pennsylvania and the Drexel Institute. In the evening a formal reception was held at the Academy of Fine Arts. This was one of the finest functions ever given in Philadelphia. Mr. Carnegie, who had remained in New York Thursday, went to Philadelphia Friday afternoon to be present at the reception, and to accompany the visitors to Washington. Saturday morning the English visitors traveled to Washington In the afternoon, President and Mrs. Roosevelt tendered a reception, the visitors being presented by Mr. Carnegie. At the conclusion of the formal reception the President and Mrs. Roosevelt mingled with their guests in an informal way for some time. The capitol and other places of interest in the city were visited, including the Corcoran Art Gallery and the Smithsonian Institution. Sunday was spent in Washington as the different members of the party preferred, there being no special program. Train was taken at Washington on Monday morning for the all-daylight trip through the mountains to Pittsburg. A stop was made at Cumberland, Md., at noon.

The Program at Pittsburg.

On Monday evening, Oct. 31, the visiting members of the Iron and Steel Institute arrived in Pittsburg, over the B. & O., from Washington. Members of the Pittsburg entertainment committee met the party at Connellsville. This daylight trip enabled the visiting iron masters to view the coking operations at the Connellsville field, several thousand of the ovens being located along the main line of the railroad. Headquarters in Pittsburg were established at the Hotel Schenley, although a large number of the visitors were quartered at the Country Club and the Hotel Henry. On Tuesday morning the Homestead Works of the Carnegie Steel Co., Homestead, Pa., were visited. Meantime the ladies in the party were taken on a carriage ride through the parks, luncheon being served at the Country Club. In the afternoon the visitors were taken to the Duquesne Steel Works. Luncheon was served on the train that carried the party from Homestead to Duquesne. The arrangement was unique inasmuch as baggage cars served as diners, these being placed on the track adjoining the one occupied by the visitors. Since the last visit of the Institute members, 14 years ago, both plants have grown to tremendous proportions. Homestead, which was then controlled by the Carnegie interests, was still in its infancy, while the Duquesne plant had not yet come under the control of this concern. Tuesday evening a reception was tendered the visitors at the Hotel Schenley, which was attended by nearly all the men of prominence in the iron and steel trade of the Pittsburg district.

The Edgar Thomson plant of the Carnegie Steel Co. was visited on Wednesday morning. As on Tuesday, luncheon was served on the train, and in the afternoon the party was taken to East Pittsburg where the great works of the Westinghouse Electric & Mfg. Co. and the Westinghouse Machine Co. are located. The visitors manifested much interest in these works and in their extensive equipment. Dinner was served by the Westinghouse interests, the party returning at 9:30. Thursday morning was left open by the entertainment committee so that the visitors could make trips to other works in which they might be interested. At 2 o'clock Thursday afternoon about 125 of the party will leave for Cleveland, while another party numbering about 80 will leave for St. Louis later in the day.

Handsomely bound leather wallets were distributed among the visitors. These were adorned with a photograph of Andrew Carnegie and containing in the various pockets pamphlets and figures intended to impress the visitors with Pittsburg's greatness. A relief map, with the various trips to be taken by the visitors outlined, was also distributed.

The figures of Pittsburg's commercial importance contained in the booklet are extremely interesting. They show that the total tonnage of the city in 1902 was 86,636,680 tons—greater than that of London, New York, Antwerp, Hamburg and Liverpool combined. Pittsburg also holds the record for a single day's shipment by water, 399,350 tons having been shipped on June 24, 1903. In 1902, 76,950,000 tons was shipped by rail and 9,686,680 tons by water. The coal production of the district in 1902 was 36,137,346 tons or about one-eighth of the output of the United States during that year. The production of steel during that year was 5,580,600 tons, which was about a half million tons greater than the total production of Great Britain. The steel rail production was 712,300 tons, as compared with 750,000 tons, the entire production of Great Britain. The pig iron production was 4,260,768 tons. There are 43 blast furnaces in the district with a total annual capacity of 7,056,000 tons; 15 Bessemer converters with an annual capacity of 3,920,000 tons; 116 open-hearth furnaces with an annual capacity of 3,472,000 tons; and one Talbot furnace with a capacity of 67,200 tons. The total value of glass products of the district in 1902 amounted to $14,276,228, as compared with $17,150,975 for the remainder of the United States. In addition Pittsburg is the center of the United States for the production of electrical machinery and railway safety appliances, steel cars, structural shapes, pipe and tubing, tin plate, crucible steel, aluminum products, coke, pickled and canned goods and cork.

The committees in charge of the Pittsburg reception and entertainment were as follows: Executive committee—C. W. Bray, F. J. Torrance, A. M. Jenkinson, John B. Jackson, Robert Pitcairn. Program Committee—C. W. Bray, W. Lucien Scaife, Robert A. Walker, Walter M. McFarland, John McLeod, Emil Swensson, H. F. J. Porter, James Scott. Reception committee—Francis J. Torrance, A. C. Dinkey, Dr. John A. Brashear, Dr. W. J. Holland, Thos. Morrison, H. J. Heinz, John C. Oliver, John Eaton, D. C. Ripley, H. K. Porter. Entertainment committee—A. M. Jenkinson, W. Linford Smith, J. G. Bennett, H. G. Wasson, John R. McGinley, Charles A. Painter, David C. Kerr. Finance committee—John B. Jackson, Wm. McConway, W. W. Blackburn, W. N. Frew, B. F. Jones Jr., W. P. Snyder, F. L. Robbins, Wm. Flinn, Reuben Miller, Emil Winter, John Caldwell, J. W. Friend, A. W. Mellon. Transportation committee—Robert Pitcairn, W. H. Keech, W. L. Abbott, J. M. Schoonmaker, J. D. Callery; Col. Samuel Moody, Homer J. Lindsay, R. A. Finney.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market and Some of Their Wants:—

The Wilkinson Turbine Co., Birmingham, Ala., has been incorporated with a capital of $200,000. As owners of the stock of the company some of the best known men of the state are interested, one of whom is Capt. Richmond Pearson Hobson.

The International Tool Co., Chicago, has been incorporated with a capital of $20,000 to manufacture tools and machinery. The incorporators are: Wm. F. Behrens, Adolph Peck and Frank J. R. Mitchell.

The Donovon Iron & Supply Co., St. Louis, Mo., has been incorporated with a capital of $10,000, three-fifths paid in. The incorporators are: John F. Donovon, Nellie M. Donovon and Andrew Johnson.

The Jacobs Steel Excavator Co., Amboy, Ill., has been incorporated with a capital of $50,000 to manufacture machinery. The incorporators are: C. C. Jacobs, W. A. Green and F. N. Vaughn.

Robert P. Brown Mfg. Co., Brooklyn, N. Y., has been incorporated with a capital of $10,000 to manufacture wire products. The incorporators are: William W. Brown, Ridley Park, Pa.; H. E. Bates, New York; E. S. Davison, Brooklyn.

The Kleinberg Mfg. Co., Chicago, capitalized at $250,000, has been incorporated to manufacture engines. The incorporators are: Elmore Kleinberg, H. R. Thompson and A. I. Chisam.

The Wagner Mfg. Co., New York City, has been incorporated with a capital of $500,000. The directors are: Thomas J. Creamer, A. Alexander, Nicholas A. McManus, Henry P. Morrison, Edward A. Alexander, Edward M. Muller, New York City; James A. Ross, South Middleton, Mass.

The Tennessee Stove Works, Chattanooga, recently incorporated, have elected the following officers: J. L. Caldwell, president and treasurer; G. N. Henson, first vice president; R. D. Davenport, second vice president; G. W. Corey, secretary; H. A. Starr, superintendent. All of the above are directors, with the addition of J. L. Foust and R. L. Wascott. The buildings to be erected will have about 50,000 sq. ft. The company desires to correspond with the manufacturers of the following: Lumber, brick, roofing, sashes for windows, engine and generator, copper wire conductors, motors, motor grinders, exhaust tumbling mills, blowers, cupolas and band saw, small.

The Magna Mfg. Co., New York City, has been incorporated with a capital of $500,000, to manufacture machinery. Incorporators and directors for the first year are: T. J. Creamer, N. A. McManus and Ed A. Alexander.

The American Roller Bearing Co., South Framingham, Mass., has been incorporated with a capital of $325,000. Officers are: President, William B. Lambers, 287 A street, Boston; treasurer and clerk, Frederick B. Hill, South Framingham.

The Safety Nut Lock Co., Minneapolis, Minn., has been incorporated with a capital of $100,000.

The J. L. Schureman Co., Chicago, has been incorporated with a capital of $50,000, to manufacture tools. Incorporators are: J. L. Schureman Jr., S. M. McFedries and C. F. Samms.

The Dobbins Iron Works, Ltd., Jennings, La., have been incorporated with a capital of $150,000. Officers are: Elmer E. Dobbins, president and treasurer; Jackson H. Heinan, vice president, and Euclide D. Connor, secretary.

The Bacon & Collins Supply Co., Albany, Ga., is in the market for one 66-in. doublehead wheel lathe for turning driving wheels and boring large pulleys; one 36-in. lathe to swing 8 ft. between centers; the 24-in. engine lathe to swing 6 ft. between centers, milling machine, shaper, planer, steam hammer, bolt machine and other equipment.

Fires and Accidents:—

The machine shop and foundry of E. D. Jones & Co., Pittsfield, Mass., were damaged by fire Oct. 23.

The plant of the Bridgeport Boiler Works Co., Bridgeport, Conn., was destroyed by fire Oct. 20.

Fire which started in the paint shop of the Metal Shingle Co., Preston, Ont., a few days ago resulted in the total destruction of the main building. The loss is about $30,000.

Fire in the plant of the New Home Sewing Machine Co., Orange, Mass., caused a loss of $100,000, covered by insurance.

New Construction:—

The P. A. & P. E. Dutcher Co., Milwaukee, Wis., has completed a new foundry for the manufacture of steel castings. The company is receiving estimates on the erection of a new open hearth furnace for steel castings which will be added to the present plant.

The Steubner Iron Works, Long Island City, Long Island, will erect a new plant on land recently purchased on Vernan avenue, which will consist of a two-story brick building, 100 x 180 ft., extension, 50 x 180 ft., and a storage shed, 30 x 200 ft. The equipment now in use will be moved to the new plant, and not much new machinery will be required.

The Simplex Railway Appliance Co., New York, has purchased 43 acres in Lachine, Canada, on which it will build a large plant for the manufacture of its specialties in steel cars. The company has a plant in Montreal, from which equipment will be moved to the new plant. Some additional equipment will be purchased later.

Extensive improvements are being made by the Thomas Furnace Co., Milwaukee, Wis., to its furnace. It has been relined and equipped with a new hearth and bosh. A new slag pit is being constructed and a new steel cast house will be built. The furnace will be blown in this month.

It is expected by the officers of the Peoria Steel & Tool Co., Peoria, Ill., that the plant will be opened by Dec. 1. At that time 100 men will be placed at work and the force will be increased as conditions warrant. The machine shop is now ready for the roof and the foundation for the steel mill has been finished.

The Edwards Mfg. Co., Augusta, Me., has nearly completed extensive repairs to its plant. The company suspended operations over three months ago and has been busy repairing and replacing old machinery, besides fitting up a room to be used as a machine shop. About $80,000 has been expended. The old machine shop has been turned into a carpenters' workshop, and a new shop, 100 x 60 ft., has been fitted up for machinists.

The Bryden Horse Shoe Co., Catasauqua, Pa., will build an addition to its plant. The new building will be 50 x 180 ft.

The Modern Mfg. Co., Spokane, Wash., will build a plant for the manufacture of farm machinery. It is expected that the plant will be in operation by Feb. 1.

The promoters of the Yielding Barb Wire Co., Peoria, Ill., announce that nearly enough money has been subscribed to secure the success of the enterprise, and that they are looking for a site on which to locate the plant.

The Cincinnati Southern railroad expects to make extensive improvements to its shops at Chattanooga, Tenn., and Somerset, Ky. The plans for Chattanooga provide for a building 334 x 125 ft. It will be partly three-stories, and will be on the site of the present shops near the Queen and Crescent freight depot. The company has recently purchased a tract of land at Somerset for the extension of its freight yard facilities.

The Gillette Roller Bearing Co., Grand Rapids, Mich., has

completed a two-story building and will engage in the manufacture of a ball bearing baggage truck.

The Rock River Mfg. Co., Dixon, Ill., will build an addition to its foundry which will double the present capacity. The business has been increasing rapidly.

The Thompson Iron Works, 1825 Callowhill street, Philadelphia, will build a three-story addition to its plant.

The first of the very extensive group of the Canadian Pacific railway road's shops at Winnipeg, Can., is now in operation. The freight car shop is now working, the passenger car shops will also be ready at an early date and still other buildings will be completed before the beginning of spring.

The bonus necessary to secure the erection of the boiler plant to be built by Broderick & Quinlan, Hartford City, Ind., has been raised. The building will be 120 x 310 ft.

J. B. Newlin is organizing a company and will build a foundry and machine shop at Sebring, O.

Joseph Faris, owner of a foundry at Springfield, Ill., will soon begin the erection of a machine shop, three stories, equipped with modern machinery.

The Clinton Iron Works, Clinton, Tenn., has let the contract to build a new foundry building which the company expects to have in operation within 60 days. The officers are: C. J. Sawyer, president; Arville Taylor, vice president; W. L. Owen, secretary and treasurer; A. E. Radert, assistant secretary and treasurer; and C. H. Johnson, general manager

The Franklin Mfg. Co., Syracuse, N. Y., is enlarging its plant and the number of employes will be increased this winter to between 700 and 800.

At Kingsland, N. J., nine miles from Hoboken, the Lackawanna R. R. is to establish a car and locomotive repairing plant that will be the largest of its system. It is intended to furnish facilities for most of the coach repairs for the road, the freight repairs being made at the new Keyser Valley shops, near Scranton. The Kingsland building will be 661 x 220 ft. divided transversely by three fire walls into two erecting shops, paint shop and truck repair shop.

It is officially announced at Gadsden that the Alabama Steel & Wire Co. will supplement its blast furnace and steel plants by building in Gadsden a steel wire rod and wire nail mill to be known as rod mill No. 2, the Ensley plant being designated rod mill No. 1. President Schuler states that the plant will be built as soon as possible, but he is unable to state exactly when the work will be begun.

The Barber & Coleman Co., Rockford, Ill., will soon break ground for another building. The new structure will be of the same style as the present plant but will be of different dimensions although of practically the same capacity. The company manufactures machinery used in the textile industries.

The Chattapooga Implement Mfg. Co. East Chattanooga, Tenn., expects to build an additional molding room, but plans will not be completed before Jan. 1.

General Industrial Notes:—

The first of a consignment of 40 electric locomotives for the New York Central & Hudson River Railroad Co., which have been under completion at the Schenectady works of the American Locomotive Co., was delivered to the General Electric Co. Oct. 25, for finishing touches. The locomotive is for the New York terminal service, and is being built by both the General Electric and locomotive companies. It is for experimental purposes. An informal test made Oct. 27 by W. K. Vanderbilt and others was very satisfactory.

The complete resumption of the steel department of the Minnequa plant of the Colorado Fuel & Iron Co. is scheduled for early in November when it is expected that the converter will again go into blast and the rail mill will resume.

Messrs. Schwartz and Smith, Sheboygan, Mich., will establish a machine shop at Manistique, Mich. They will make a specialty of repair work.

The C. Hanika & Sons Iron Works, Celina, O., have been sold at receiver's sale to C. D. Hierholzer, of the Commercial Bank Co., of this city, for $6,875. This plant cost Celina $19,900 in the way of a bonus a few years ago. It is understood that Mr. Hierholzer intends to operate the plant.

The Montgomery Iron Works, Montgomery, Minn., have been sold to the New Prague Foundry Co., of New Prague, Minn., and are now being moved to that city.

The property formerly owned by the Kellogg Tube Works, Findlay, O., has been sold to the Kennedy Valve Co., which will move the equipment to a small town within a short distance of New York City, where it will be used by the purchasers. The property was sold by Attorney A. G. Fuller.

The Consolidated Wire Fence Co., Minneapolis, Minn., has moved from Hutchinson to Minneapolis, giving discriminating freight rates as the reason for the change.

The foundry at the plant of the Superior Division of the American Seeding Machine Co., Springfield, O., has been started and in a few days all of the departments will be in operation. The plant employs about 450 men. It was closed only temporarily.

The Union Pacific railroad contemplates converting the rolling mills at Laramie, Wyo., formerly owned by the Colorado Fuel & Iron Co., into a plant for the manufacture of railroad spikes and other iron products.

Early in November three blast furnaces of the Minnequa plant, of the Colorado Fuel & Iron Co., will be in operation, and shortly thereafter the fourth will be added. The bosh for E furnace has been completed.

It is the expectation that the new Gravity Iron Works, which will occupy the abandoned plant of the Carbondale Metal Working Co., Scranton, Pa., will be in operation next month.

Miss Edith Lewis, daughter of David D. Lewis, superintendent of the steel plant of the Lake Superior Corporation, pulled the electric switch that lighted the fires in the blast furnaces of the corporation, Oct. 17.

The business of manufacturing the Boulter brand muffles and other shapes in high grade fire brick, which has been conducted continuously at 1617 to 1627 North street, Philadelphia, for 69 years, has been incorporated under the title of the Boulter Mfg. Co., Inc., and will be continued at the same address.

Repairs which have been under way at the Greer mill of the American Sheet & Tin Plate Co., New Castle, Pa., for several months have been completed. No date has been set, however, for resuming operations.

The North Works of the Carnegie Steel Co., Sharon, Pa., resumed operations this week after an idleness of three weeks. The blooming and skelp mills are operating in full.

Fourteen of the mills of the Aetna-Standard plant of the American Sheet & Tin Plate Co., Bellaire, O., are in operation this week. The mill has operated only in part for many months and with fourteen mills in operation the plant is doing better than for some time.

The report that the Carnegie Steel Co. would dismantle its Lindsay & McCutcheon, Clark and Painter mills at Pittsburg, and would centralize its hoop and band manufacture at Monessen, Pa., where one of its most modern plants is located, has been officially denied. The plants in Pittsburg are not modern and are all located in the congested districts and that a step in the direction of concentration will be taken at some time in the future is a certainty.

At a meeting of the directors of the Pressed Steel Car Co., Pittsburg, held last week, the regular quarterly dividend of 1¾ percent was declared on the preferred stock. The dividend on the common stock was passed. For the first two quarters of this year the dividend on the common has been at the rate of four percent a year.